MONTANA
Fish and Game Commission

Wildlife Restoration Division

IMPACT OF THE PROPOSED LIBBY DAM UPON THE WILDLIFE RESOURCES OF LINCOLN COUNTY, MONTANA

A study by

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Not for Publication

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C O N T E N T S

INTRODUCTION

Within the last two decades national attention has been increasingly guided toward the economic development of the Northwest. One major phase of this regional development has been the widespread interest in harnessing and developing the tremendous water power potentials invested in the network of the northwestern streams and rivers. This task, undertaken and pursued in an effort to cope with increased power demands and flood control measures, is by no means completed. Construction of stratigically located dams will continue as their need arises.

The construction of a dam to harness the tremendous energy potential can, by no means, be viewed solely as an engineering feat. Multiple land use and the coordinated development of natural resources are essential phases of the region's economy that also warrant intensive study and consideration. It is impossible to construct a large dam and flood a sizeable area of land without creating major interrelated problems and effects in the locality where that occurs.

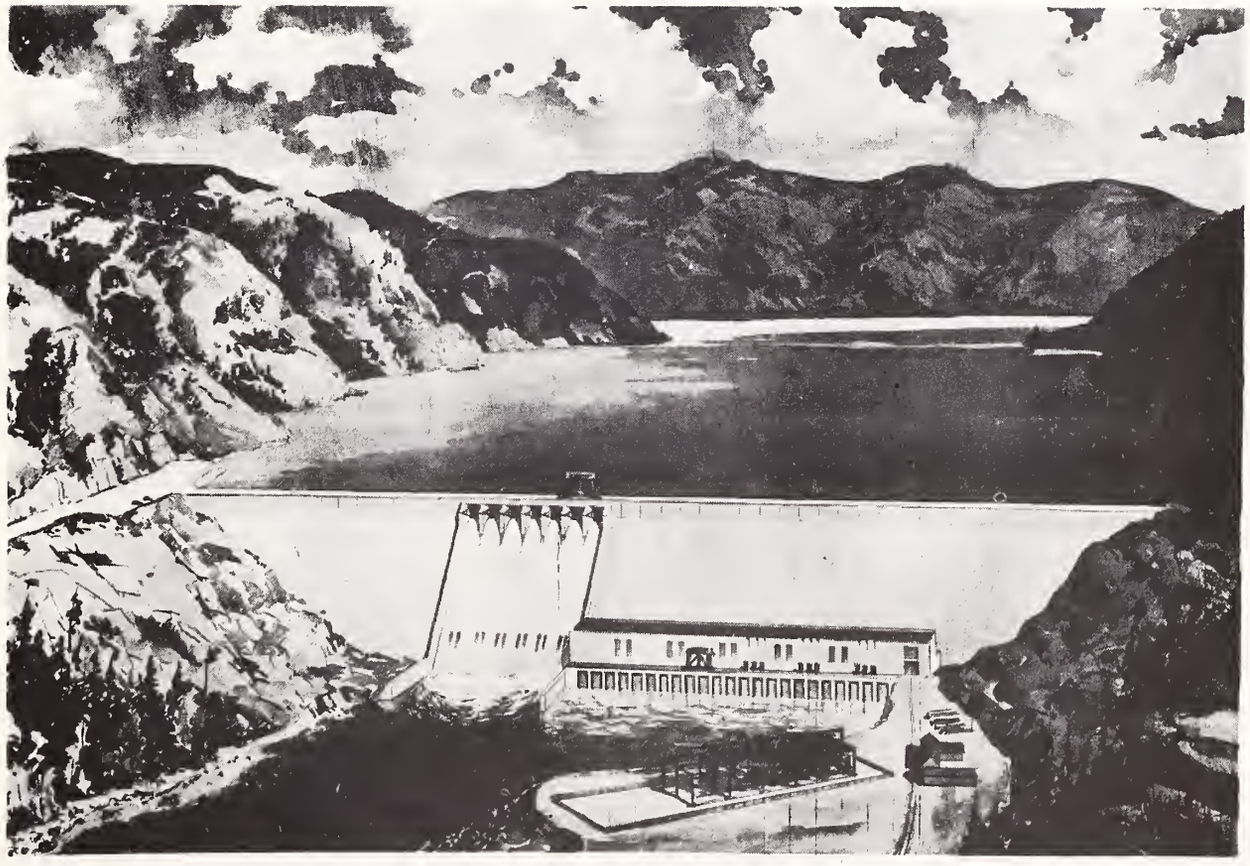

Figure 1a. Artist's sketch of the proposed Libby Dam. 1/

1/ Figures 1a and 1b reprinted from the U. S. F. S. report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953.

The findings borne out in the following report have been directed toward one major aspect of the interrelated problem of dam construction to the continued development of economic resources: the impact of the proposed Libby Dam (Figure 1a) upon the wildlife resources of Lincoln County, Montana.

The limitations of this wildlife investigation project should be clearly recognized. The data presented herein have no particular bearing on the restoration of displaced transportation facilities or economic forest resources and facilities in the event of dam construction. These aspects have been investigated and reported on in considerable detail by other agencies of authority. Furthermore, this report presents only a few of the facts relative to a desirable site for the construction of the dam itself. There are numerous other factors to be considered in regards to this matter, many of which bear, no doubt, a greater significance.

In appraising the wildlife resources only big game will be stressed in this report since it is the resource of major significance that would be affected by the proposed Libby Dam and reservoir. A few mallards, baldpates, pintails, goldeneyes and American mergansers are occasionally seen along the Kootenai River but since it is not on an important migration route the waterfowl habitat loss by impoundment would be negligible. Beavers, muskrats, minks and otters are the principal fur animals inhabiting the reservoir site. Studies on other fluctuating reservoirs indicate that the beaver and muskrat habitat will be destroyed but mink and otter will continue to use the shoreline of the impoundment. However, field studies indicate that the loss would be small in relation to the over-all wildlife aspect. The same is true of ruffed grouse, the only species of upland game birds that would be affected by the proposed dam.

THE PROPOSED LIBBY DAM

The Kootenai River in Lincoln County (Figure 1b) is favored by having a number of sites suitable for the construction of a dam. The Corps of Army Engineers has investigated twelve sites on the river between Libby and twenty miles upstream. To date the selection of one of these has not been definitely approved, which has complicated this study. However, in lieu of this pending decision two locations which appear to be the most probable choices have been considered:2/

1. Mile 204.9 above the confluence of the Kootenai and Columbia Rivers, approximately three miles upstream from Libby, Figure 8.

2. Mile 217.0 above the confluence of the Kootenai and Columbia Rivers, approximately fifteen miles upstream from Libby, Figure 19.

Construction of the authorized multiple-purpose Libby Dam project will be an engineering feat of great magnitude. A 425-foot dam at the lower site (Mile 204.9) would involve an expenditure of $284,000,000 and create a reservoir 107 miles long, extending 42 miles into British Columbia, Canada.

The reservoir would have a maximum elevation of 2,459 feet above sea level and flood approximately thirty-eight thousand acres in the county. Two small towns, Rexford with a population of approximately three hundred and Warland with 39, would be inundated. The total population within the proposed flowage area is about six hundred people. Approximately fifty-six miles of State Highway No. 37 and the same distance of mainline track of the Great Northern Railway would be flooded. In addition, nearly one thousand miles of forest development roads would be either inundated or affected.

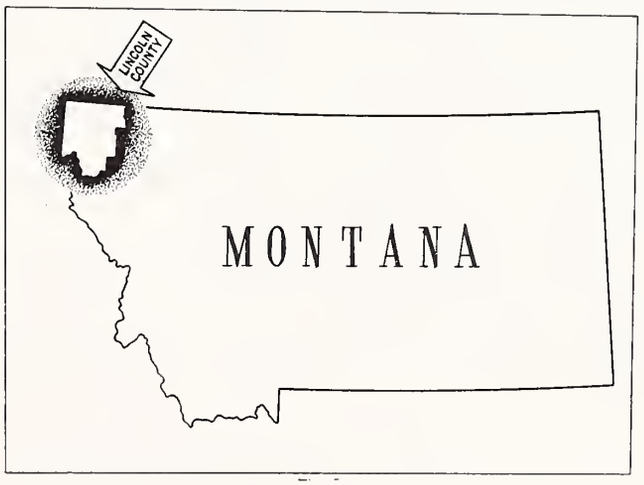

Figure 1b. Lincoln County

Considered from a beneficial aspect, the dam would create large returns in the way of flood control and power generation. The Corps of Army Engineers estimate the benefit-to-cost ratio at this site to be about

2/ These two construction sites are the same as those evaluated in the U. S. F. S. report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953.

two to one. In addition to the at-site power production, the dam would add substantially to the contribution of the federal power plants completed or under construction on the Columbia River.

A dam 400 feet high and 2,700 feet long at the upper site (Mile 217.0) would create a somewhat shorter reservoir, flooding approximately thirty thousand acres within the county. The maximum full pool elevation would be the same as that of the lower site (2,459 feet), with only 44 miles of Highway No. 37 and Great Northern Railway inundated. However, the population dislocations would be but little less than for the lower dam site as the towns of Warland and Rexford would still be in the reservoir area. Table 1 classifies the land within the flowage basin for each dam site.

Table 1.[3/] Character of land which would be flooded by a dam with a crest 2,459 feet above sea level.

	Lower site	Upper site
Cultivated and improved pasture	2,100	1,800
Natural grassland	7,000	6,200
Forests	15,500	10,100
Waste, barren, brush, roads, railroads, etc.	8,900	8,500
Townsites	200	200
Riverbeds, sloughs	4,300	3,400
Total	38,000	30,200

Another important matter which has hampered the study to some extent has been the indecision on approved relocation of major transportation facilities relative to the dam construction sites. However, an equitable solution to this transportation problem has been investigated by the U. S. Forest Service for construction sites at Mile 204.9 and Mile 217.0. The importance of these alternative restoration plans, which have been considered in this report, and their possible influence upon existing wildlife resources can be, by no means, slighted in attention.

3/ Reprinted from U. S. F. S. report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953.

ORIGIN OF LIBBY DAM - WILDLIFE RESOURCE INVESTIGATION

The Libby Dam, authorized by Congress in the flood control act (Rivers and Harbors Act) on May 17, 1950, was recommended as a major element in the master control plans for the Columbia River basin. This authorization, anticipated long before 1950, cited construction of the dam as a Corps of Engineers project. Public hearings were held on April 17, 1947 and July 7, 1948 at Libby, Montana and again on July 27, 1948 at Bonners Ferry, Idaho. Proceedings of these hearings were placed on record.

In January 1952 the U. S. Forest Service, Region One, Missoula, undertook an intensive investigation concerning the impact of the proposed Libby Dam on the administrative development and utilization of large areas of national forest land within the Zone of Influence. The project was financed in part, by the Corps of Engineers from its planning fund. A complete report of this study, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, was submitted to the Corps of Engineers in August of 1953.

On January 5, 1953 Mr. James F. Ashley, Assistant Regional Supervisor, Federal Aid, Fish and Wildlife Service, Portland, addressed a letter to Mr. Robert H. Lambeth, State Game Warden (at that time), Montana Fish and Game Department, requesting a meeting in Libby with the Lincoln County Deer Study personnel to discuss the proposed Libby Dam and examine the area to be affected by the impoundment. Mr. Dana P. Berghuis of the Branch of River Basin Studies, Fish and Wildlife Service, Portland, was also contacted for attendance. The meetings were held on January 20, 21 and 22.

Duane P. Couvillian, formerly attached to the Lincoln County Deer study, was assigned in December 1952 to conduct a preliminary survey of wildlife resources within the proposed impoundment area of Dam Site Mile 204.9. Shortly after the meeting with Messrs. Ashley and Berghuis in Libby a Libby Dam-Wildlife Resource investigation study plan (herein reported) was formulated and attached to, and under the direction of the Lincoln County Deer study. On June 6, 1953 the study was approved by the Fish and Wildlife Service as a Pittman-Robertson investigations project financed through Federal Aid (64 Stat. 430 and 50 Stat. 917). Mr. Couvillian was then delegated to proceed with the investigations as set forth in the approved plan. Progress on the study was seriously retarded by variable factors and on June 1, 1954 a reassignment of personnel was made to continue the investigation to completion.

During the early part of 1953 the River Basin Studies Branch of the Fish and Wildlife Service also conducted a study of the Libby Dam in conjunction with the effect on wildlife resources. The investigation was carried on by Mr. Berghuis. Results of this study have been held in abeyance pending decision on a suitable dam construction site.

A number of individuals and agencies were very cooperative in giving assistance to the study reported herein. Owen A. Wilson, formerly an employee of the Montana Fish and Game Department, assigned as a biologist on the Lincoln County Deer Management Study, contributed tremendously toward the completion of this investigative study. Through field and office discussions he was of great help in analyzing many phases of the reservoir impact problem. Also, his participation as a biologist in the Lincoln County Deer Study resulted in many findings, relative to big game, which were of essential value to this study. John B. Dillon, biologist recently assigned to the Lincoln County Deer Study, was also very helpful in assisting with the editing and preparation of the report for submission.

Howard E. Ahlskog, Alfred A. Flint, John R. Milodragovich, Leroy W. Lewis, E. S. Albert and Harry M. Kins, U. S. Forest Service, Kootenai National Forest, Libby, assisted in consultation on big game ranges and granted the use of forest map facilities; William Burgess and George Searight, U. S. Forest Service, Region One, Missoula, assisted in the drafting and printing of maps used in the study; Jack Schmautz and Ade Zajanc, formerly employed by the Montana Deparment of Fish and Game, conducted wildlife studies in Lincoln County between 1948 and 1951, many phases of which were applicable to this investigation; William Bergeson, Senior Biologist for the Fish and Game Department, conducted big game studies in the area during the early 1940's which were of great value; Messrs. Berghuis and Hazeltine, River Basin Studies, cooperated with the State Fish and Game Department by assisting in the field work and making of a vegetative cover-type map (acetate overlay on aerial photos) of the flowage area, which was later loaned by their department for study, compilation and drafting; and the J. Neils Lumber Company which has assisted by granting permission to conduct wildlife studies on their land in the past years. Many portions of these studies have been applicable to the Libby Dam-Wildlife Resource investigation.

The foregoing acknowledgements, by no means, constitute a complete listing of all cooperative individuals or agencies. However, appreciation for assistance is equally extended to unintentional ommissions. Many wildlife studies have been conducted by both the U. S. Forest Service and Montana Fish and Game Department on or adjacent to the proposed Libby Dam area during the past several years. The findings of these studies were of great value to this report.

The findings and conclusions presented herein represent the opinions of the Montana Fish and Game Department in accordance with the limitations of the investigative study.

SUMMARY OF FINDINGS AND CONCLUSIONS

The proposed Libby Dam and reservoir cannot be regarded solely as an engineering project, though this is the more popular conception. In reality the major geographical alterations and ensuing effects upon multiple land use values, resulting from such a structure, are of far greater significance. It was therefore essential that precise evaluations be made of the relationship of these land values to dam construction as an integral part of coordinated project planning. In view of the need for such data the Montana Fish and Game Department undertook a thorough investigation of the effects of dam construction upon the wildlife resources of Lincoln County, Montana, one major phase of the overall land use value aspect.

From this intensive study it was concluded that the impact of the proposed Libby Dam upon waterfowl populations would be negligible. The area of concern is not on a principal migration route and is frequented by only relatively few birds. The effects upon upland game birds were also determined to be of little significance. It was found that fur bearers would realize some effect, by species, though their populations were not in sufficient abundance to have warranted intensive consideration and study. From findings of similar studies conclusions were that both beaver and muskrat habitat would be destroyed by the proposed reservoir though mink and otter would continue to utilize the impoundment shoreline.

Field studies indicated that the total loss to the three preceeding wildlife groups would be small in relation to the overall resource. The phase of greatest concern was found to be various big game populations, namely, deer, elk and mountain sheep. Not only would the reservoir flood out winter range areas essential to the welfare of these desirable species, it would also necessitate the relocation of the Great Northern Railroad through big game winter concentration areas.

The analyses contained in this report have shown that in so far as this area is concerned, one of the most important big game aspects to consider in relation to the Libby Dam, is the species behavior responses to the impoundment. By and large, any factor that alters the winter habitat will in turn alter normal animal behavior patterns. The analyses have further shown that these big game impact responses are, to a great extent, unpredictable and cannot be concluded with any certainty at the present time.

The effects of the impoundment relative to the above big game species were evaluated primarily on the basis of conditions that prevail during critical winter periods of excessive snow accumulation. This was founded on the premise that the availability of winter range governs the populations that can be properly maintained. It was found that the proposed reservoir for either Dam Site 204.9 or 217.0 would inundate a great portion of the bottomland range area essential to deer and elk during critical periods, more especially to white-tailed deer.

In as much as the responses to impact would vary by species as well as by range areas, the Zone of Influence for both Dam Sites was divided into distinct units, each capable of being managed individually. Even though variations in impact response were found existant between units the overall actions necessary to alleviate adverse effects are, in general, applicable to all areas. The extent of compensatory action would vary by species per unit.

To compensate for effects provoked by dam construction at either Site 204.9 or Site 217.0 deer, elk and mountain sheep populations will necessarily have to be reduced and maintained in accordance to each species need for the bottomland range during critical winter periods. From the analyses it was found that white-tailed deer will realize the greatest impact. The lowlands to be flooded are essential to the entire species population during critical periods. Due to the desirability of white-tailed deer as a huntable resource, elk herds will have to be controlled in relation to their adverse effect upon the residual wintering deer population. Lowland flooding will also necessitate a reduction in mule deer numbers, though only in herds from Jennings to the Canadian border. Of the four big game species in question, mountain sheep will realize the least impact. In view of this, immediate adjustment to their herd numbers appears unnecessary.

Another phase of impact to warrant consideration is the imposement of a reservoir upon spring and fall ancestral migration routes. From the analyses it was found that the impoundment would place an approximate three-quarter mile water barrier upon a major white-tailed deer migration crossing. To conclude the effect of this introduced obstacle is not feasible. However, should the animals continue ancestral movement across this water area, ice conditions will provoke an added hazard, its severity dependent upon climatic factors. Thin or extensive edge ice could result in the loss of many animals.

In the event of dam construction at either Site 204.9 or 217.0, relocation of the Great Northern Railroad around the flowage area will be necessary. Suggestive relocation plans have been submitted by the U. S. Forest Service. To compensate for dam construction at Site 204.9 the railroad would be routed so as to pass through the southern half of a major white-tailed deer winter concentration area in the lower Fisher River-Wolf Creek drainage. For Site 217.0 rerouting would be through the northern half of this same winter area. During periods of excessive snow depth the deer would, by nature, congregate upon the cleared railroad tracks, thereby inducing substantial population losses with each passing train. To alleviate this detrimental problem it has been recommended in this report that the railroad right-of-way be properly fenced against big game through the concentration area.

It can be concluded that regardless of actions undertaken to compensate for the impact of the proposed reservoir, the ultimate and overall effects of dam construction at either River Mile 204.9 or 217.0 will be detrimental to the existing populations of deer, elk and mountain sheep. The potential area value of recreation in the form of both wildlife aesthetics and big game hunting will undoubtedly be seriously impaired.

THE STATUS OF WILDLIFE RESOURCES IN LINCOLN COUNTY

Dating back to early historic records all varieties of wildlife adaptable to the area have been regarded as a valuable and abundant resource to Lincoln County. The early explorers and trappers, the miners that followed, and eventually the railroad construction men all depended on the native game as an important item of subsistence. In general, game animals have played an important role in the development of the area as wild meat was one of the chief sources of food.

Deer have always been the most abundant game species. Between 1898 and 1900 their hides were used as legal tender with a value of fifty cents per hide. As a result of the continual heavy hunting pressure deer herds became seriously depleted by 1900, thereby necessitating conservation measures as a means of alleviating the problem. Improved interest in wildlife conservation, better law enforcement, predatory animal control, and the advent of game management practices accounted for the gradual increase in deer herds. However, it was not until after 1933 that a remarkable build-up in numbers became evident. The establishment of the Wolf Creek Game Preserve in 1923, the inauguration of a buck law and the creation of the Graves Creek Game Preserve in 1933, followed by a series of years favorable to game animal production, have been the factors largely responsible for the development of one of the largest deer concentration areas within the State of Montana.

The county as a whole lends itself to the production of deer. Topography, climate, vegetative cover, and other environmental factors make this one of Montana's most ideal areas for the continuation of ample game resources, especially deer, under the guidance of sound management practices.

Big game population estimates made by the U. S. Forest Service and the Montana Fish and Game Department from 1919 to 1954 for Lincoln County (2,341,000 acres) appear in Tables 2 and 3.4/ These figures give an indication as to the recreational potential in the form of big game hunting within the county. The economic value of this natural resource by way of annual hunter expenditures can total a tremendous sum to the people of Montana.

In 1950 it was estimated that resident big game hunters in the State spent an average of $65 per year and non-residents $385 per year. With these figures as a basis it can be noted that during 1953 there were 117,984 resident big game tags and 1,607 non-resident tags sold in Montana, thus totaling a multi-millon dollar hunter expenditure. Even though Lincoln County is situated in the more remote portion of the state its big game resources have for many years attracted a sizeable hunter population, both resident and non-resident. The economic

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4/ Estimates are primarily those recorded on the Annual Wildlife Report, Region One, U. S. Forest Service, Missoula, for the Kootenai National Forest.

importance of this county asset can, by no means, be slighted when considered as an integral part of the total fish and wildlife resource value of the northwest area.

Table 2. Big Game Population Estimates for Lincoln County, Montana (1919 - 1954, inclusive).

Year	White-tailed Deer	Mule Deer	Total Deer	Elk	Moose
1919			16,500	20	
1920			15,500	20	
1921			12,000		
1922			12,000		
1923			13,500	10	
1924			14,000	20	6
1925			10,000	30	6
1926			11,000	15	1
1927			11,500	45	1
1928			7,925	66	3
1929			7,560	188	4
1930			7,550	238	11
1931			7,700	309	17
1932			5,095	365	20
1933			5,800	460	27
1934			5,525	764	60
1935			12,050	795	69
1936			20,270	490	59
1937	12,900	7,300	20,200	525	68
1938	7,720	6,850	14,570	520	80
1939	7,430	6,900	14,330	410	100
1940	9,355	7,295	16,650	460	130
1941	10,500	7,590	18,090	220	140
1942	11,000	7,700	18,700	50	150
1943	8,900	8,000	16,900	380	180
1944	8,950	7,720	16,670	456	194
1945	10,100	7,975	18,075	531	309
1946			18,060	416	257
1947	14,000	6,250	20,250		282
1948	12,708	4,584	17,292	610	307
1949	14,150	8,225	22,375	620	520
1950	15,000	7,800	22,800	630	330
1951	15,000	9,000	24,000	830	450
1952	15,000	10,000	25,000	1,065	510
1953	15,000	10,000	25,000	1,100	400
1954	18,000	10,000	28,000		

Table 3. Big Game Population Estimates for Lincoln County, Montana (1919 - 1953, inclusive).

Year	Mtn. Sheep	Mtn. Goats	Black Bear	Grizzly Bear
1919	30			
1920	30		370	30
1921	30		370	30
1922	35		370	30
1923	35		400	35
1924	50	40	440	35
1925	50	150	500	40
1926	60	250	650	35
1927	75	275	700	45
1928	75	172	555	37
1929	90	201	641	51
1930	60	114	610	34
1931	120	128	615	34
1932	120	130	610	30
1933	145	118	565	30
1934	145	168	800	62
1935	145	176	780	67
1936	128	141	770	60
1937	120	120	810	53
1938	120	150	830	60
1939	110	150	750	60
1940	150	150	930	65
1941	150	150	1,000	70
1942	160	150	1,100	63
1943	145	210	1,100	65
1944	150	160	1,215	57
1945	150	175	1,236	78
1946	152			
1947		195	1,217	80
1948	152	220	1,205	83
1949				
1950	300			
1951	355			
1952	320			
1953	400			

To date there is little information available on hunter-deer harvest for Lincoln County as a whole. However, the general pattern established on key areas indicates a deficiency in the proper use value of the herds. The Montana Fish and Game Department estimated that the legal harvest for the county, during 1947, was only 5.7 percent of the fall population. During the regular hunting season of 1949, 602 bucks were harvested and with a special post-season hunt an additional 146 bucks and 432 does and fawns were killed. The combined factors of deficient harvest and increasing herds have antagonized the problem of overutilized winter ranges and a substantial periodic winter deer mortality. The immediate need for a more useful development of the resource is apparent.

Fur bearers, upland game birds, and waterfowl also comprise a portion of this recreational resource, though the latter group does not occur in any abundance. Population figures are not available for grouse. However, U. S. Forest Service and Montana Fish and Game Department estimates have considered them abundant in Lincoln County. Fur-bearing animals are potentially capable, and do contribute to the economic welfare of the people. Population estimates of fur bearers, made by the U. S. Forest Service, Kootenai National Forest, appear in Table 4.

Table 4. Fur-Bearing Animal Population Estimates for Lincoln County, Montana (1937 - 1948, inclusive).

Year	Beaver	Mink	Muskrat	Otter	Martin
1937	1,120	945			870
1938	1,485	1,020	1,955	11	845
1939	1,425	1,125	2,230	12	920
1940	1,500	1,370	2,750		820
1941	1,500	1,340	2,800		832
1942	2,100	1,200	3,500		1,000
1943	1,600	1,600	3,600	17	1,000
1944	2,270	1,305	3,825	20	1,200
1945	2,390	1,355	3,325	40	1,315
1946					
1947					
1948	2,365	1,180	4,575	50	1,200

The potential value of recreational hunting and fishing within the county is greatly in excess of the considerable revenue already earned. Many factors can impede the fullest development of this great resource. One such factor is the construction of major dams without proper planning to utilize the recreational opportunities in the area.

APPENDIX A. AREA STATISTICS

Area within Zone of Influence - Dam Site Mile 204.9

The investigative studies reported herein have been restricted, in so far as possible, to an area depicted as that zone within which the impact of the proposed Libby Dam on various wildlife species will be realized. During the course of wildlife investigations on the area one fact was repeatedly brought to bear; deer are the species that will be primarily affected by the construction of a dam on the Kootenai River, regardless of its location within the county. For this reason the major emphasis placed in determining the extremities of a reliable Zone of Influence was in direct relation to the seasonal movements and habits of the deer herds in relation to both the proposed impoundment area and the restoration of major transportation facilities. As early as 1942 personnel of the Montana Fish and Game Department in cooperation with the U. S. Forest Service were studying the seasonal migration pattern of Lincoln County deer. Since that time additional data on movements have been accumulated by both agencies whereby a reasonably accurate early winter and spring migration could be plotted, as shown in Figure 2.5/ On the basis of this information the wildlife Zone of Influence for Dam Site Mile 204.9, Figure 2, was extended to encompass all areas utilized by deer herds that winter in or adjacent to the proposed reservoir. A further analysis of this is given later in the report under Appendix B.

During the forest resource investigations conducted by the U. S. Forest Service in relation to the proposed Libby Dam a similar Zone of Influence was established, though one relative to forest development. This zone, as shown in Figures 3, 4 and 5, should not be confused with the big game area of influence adhered to in this report. Hereafter the term Zone of Influence, appearing either as in Figure 8 or as in Figure 19, will be in relation to the wildlife resource only, unless stated otherwise.

The Zone of Influence for Dam Site 204.9, Figure 8, comprises a total land area of approximately 1,218,380 acres (before deduction of flowage), of which, over 90 percent is forest land. Figures 3, 4 and 5 6/ show the general character of a major portion of this area as to forest types, land use, and ownership. (Through necessity, only the land within the forest resource Zone of Influence is classified. However, the zone is, in a large part, very similar to that used in this report).

5/ Migration studies are being conducted at the present time in Lincoln County by the Montana Fish and Game Department to gain precise and accurate knowledge on the deer herd migration routes.

6/ Figures 3, 4 and 5 reprinted from U. S. Forest Service report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953, pp. 54, 56 and 57.

SEASONAL MIGRATION ROUTES FOR DEER HERDS WITHIN THE ZONE OF INFLUENCE
DAM SITES 204.9 & 217.0
—LEGEND—
ZONE of INFLUENCE
Dam site 204.9
Dam site 217.0
Deer winter range
Migration routes
ZONE OF INFLUENCE
CANADA
IDAHO
MONTANA
FLATHEAD NATIONAL FOREST
LIBBY
Kootenai
River
204.9
217.0
REXFORD
Eureka
Black Butte
TROY
SYLVANITE
UPPER FORD
Clark
Fork
R 30 W
R 29 W
R 28 W
R 27 W
R 26 W
R 25 W
R 24 W
R 23 W
R 33 W
R 32 W
T 37 N
T 36 N
T 35 N
T 34 N
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
T 28 N
T 27 N
T 26 N
T 25 N
T 24 N

FIGURE 2

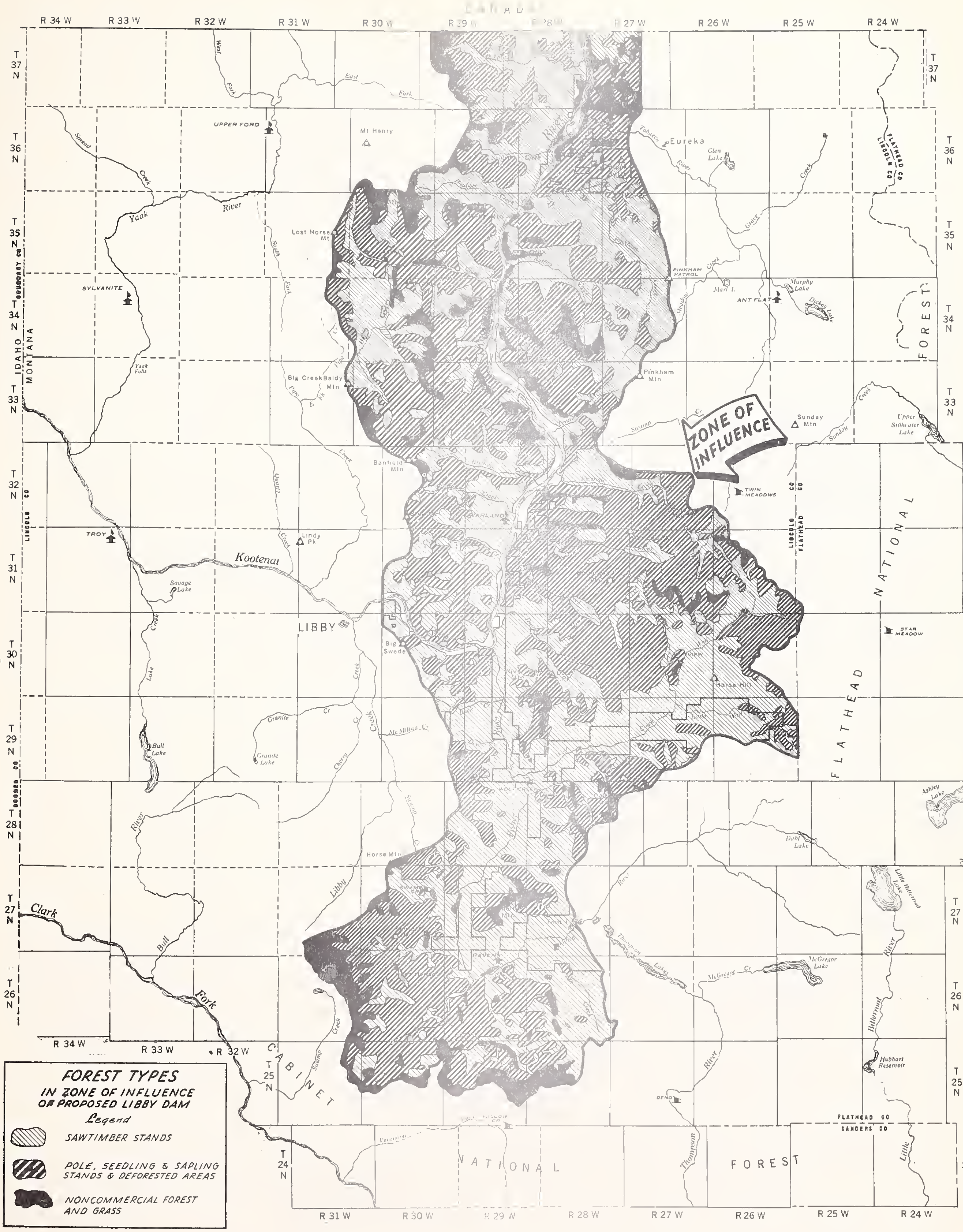
FOREST TYPES
IN ZONE OF INFLUENCE
OF PROPOSED LIBBY DAM
Legend
SAWTIMBER STANDS
POLE, SEEDLING & SAPLING STANDS & DEFORESTED AREAS
NONCOMMERCIAL FOREST AND GRASS
ZONE OF INFLUENCE
LIBBY
Eureka
TROY
SYLVANITE
UPPER FORD
Kootenai
Yaak
IDAHO
MONTANA
FLATHEAD NATIONAL FOREST
CABINET NATIONAL FOREST
LINCOLN CO
FLATHEAD CO
SANDERS CO
Mt Henry
Lost Horse Mt
Big Creek Baldy Mtn
Banfield Mtn
Lindy Pk
Pinkham Mtn
Sunday Mtn
Horse Mtn
Big Swede
TWIN MEADOWS
STAR MEADOW
ANT FLAT
PINKHAM PATROL
Glen Lake
Murphy Lake
Dickey Lake
Savage Lake
Bull Lake
Granite Lake
McGregor Lake
Hubbart Reservoir
Ashley Lake
Dahl Lake
Upper Stillwater Lake
Clark
Fork
Thompson
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Figure 3

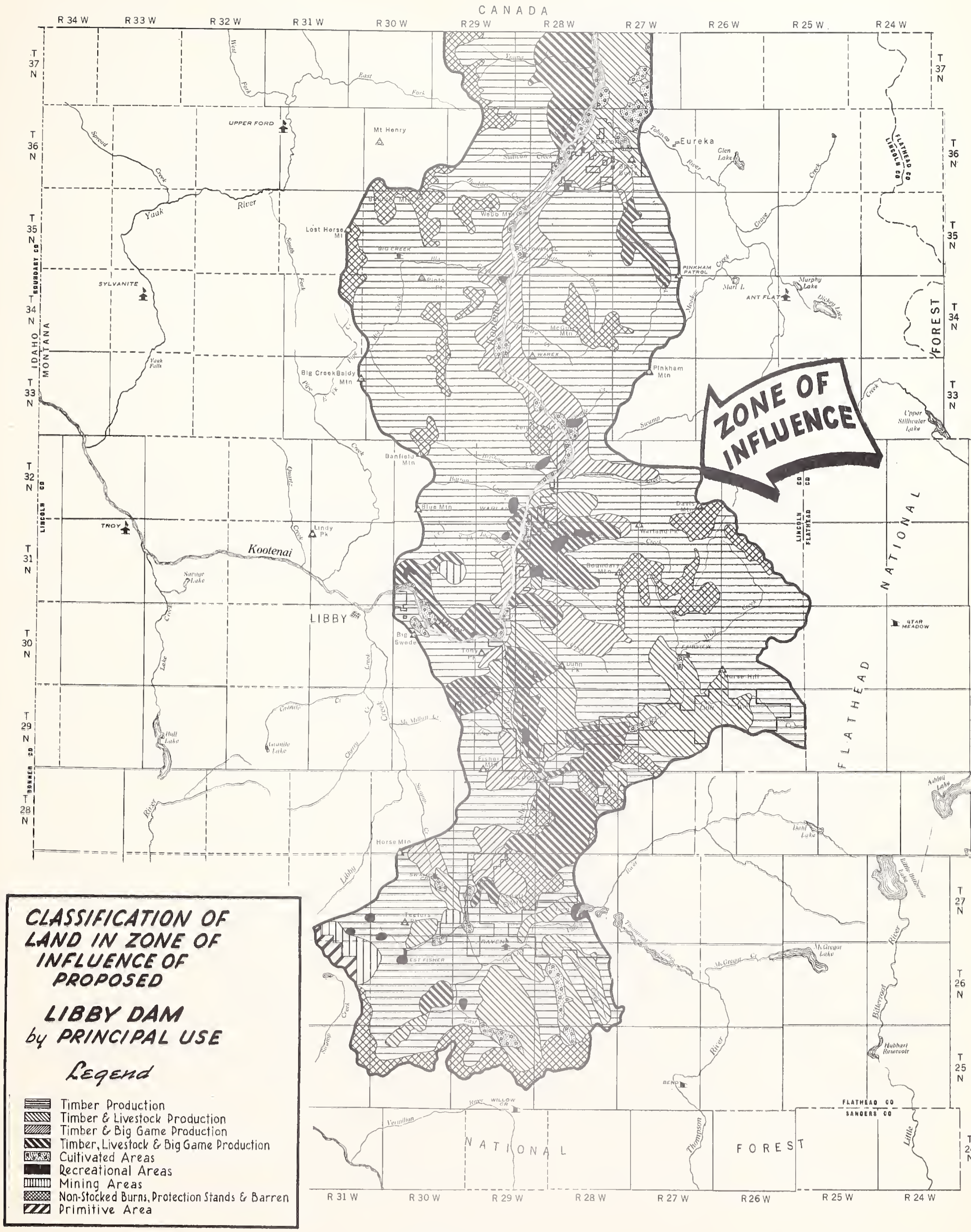
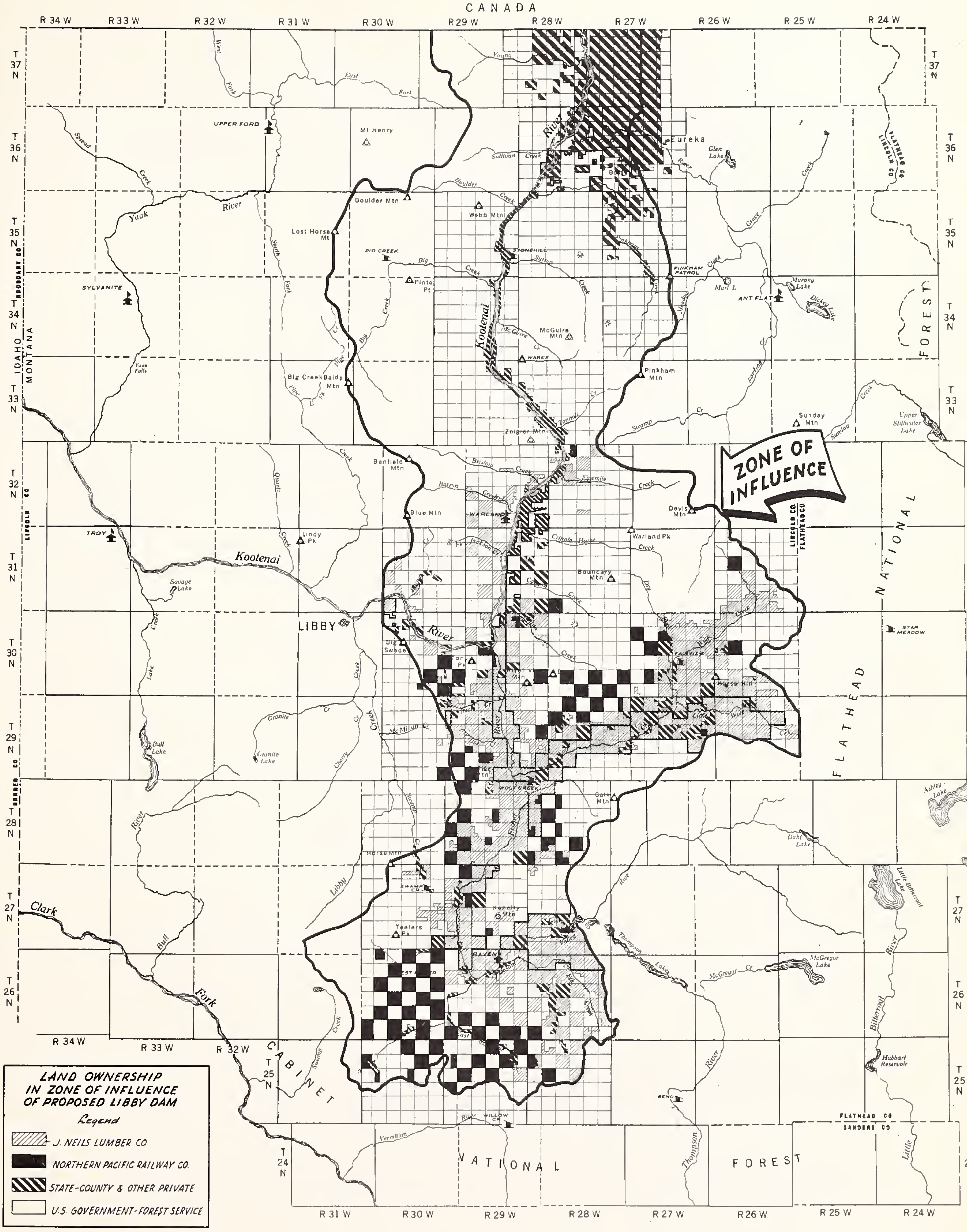

CANADA
ZONE OF INFLUENCE
CLASSIFICATION OF LAND IN ZONE OF INFLUENCE OF PROPOSED LIBBY DAM by PRINCIPAL USE
Legend
Timber Production
Timber & Livestock Production
Timber & Big Game Production
Timber, Livestock & Big Game Production
Cultivated Areas
Recreational Areas
Mining Areas
Non-Stocked Burns, Protection Stands & Barren
Primitive Area
Eureka
LIBBY
TROY
Kootenai
IDAHO
MONTANA
FLATHEAD NATIONAL FOREST
NATIONAL FOREST

Figure 4



CANADA
ZONE OF INFLUENCE
LAND OWNERSHIP IN ZONE OF INFLUENCE OF PROPOSED LIBBY DAM
Legend
J. NEILS LUMBER CO
NORTHERN PACIFIC RAILWAY CO.
STATE-COUNTY & OTHER PRIVATE
U.S. GOVERNMENT-FOREST SERVICE
LIBBY
Eureka
Kootenai River
CABINET
NATIONAL FOREST
FLATHEAD NATIONAL FOREST

Figure 5

The area as a whole is typified in having very rough, broken, and heavily timbered topography, with the exception of a portion of the Tobacco Plains located in the upper northwest section. Here the land is barren of timber and consists primarily of low, rolling hills. No specific data were compiled as to vegetative types within the zone; however, Lincoln County, of which the Zone of Influence comprises over one-half, is divided into generalized forest types as shown in Table 5.

Table 5.7/ Generalized forest types of Lincoln County, Montana.

Type	Acreage
Larch-Douglas fir	834,000
Lodgepole	361,500
Ponderosa pine	357,800
White pine	122,000
Engelmann spruce	99,300
Douglas fir	24,400
Hemlock, Cedar and Grand fir	10,500
Cottonwood	3,500
Subalpine and rock non-commercial forest	433,500
Burns	40,000
Cutover	17,500
Total	2,304,000

In general, the area can be classified into four major types of country; they are:

1. Stream-bottom types consisting of such broadleaf trees as cottonwood, birch, alder, dogwood and willow.8/

2. Open ponderosa pine types on slopes of south and west exposures.

3. Dense Douglas fir-larch-lodgepole pine types on slopes of north and east exposures.

4. Open grassy or brushy hillside types.

7/ Obtained from, Forest Statistics for Lincoln County, Northern Rocky Mountain Experiment Station, No. 2, October 1941.

8/ For convenience the scientific nomenclature for common names of trees, shrubs and grasses used in this report have been listed in Appendix D.

In addition, grass and shrub parks occur on the shoulders of many ridges, and to a lesser degree, along the stream bottoms. Also, many areas have been extensively cut over or burned and have reproduced to a variety of browse species mixed with conifers.

The major drainages of concern within the Zone of Influence are the Kootenai River, Fisher River, Wolf Creek and Libby Creek. From Rexford south, the Kootenai River flows through a relatively narrow canyon with walls of 50 to 80 percent side slope up to elevations of 5,000 and 6,000 feet. Where the canyon walls are not exposed the bedrock is overlain, on generally 60 percent slopes, with a clay silt material deposited during a prehistoric lake period. Portions of this area are shown in Figures 6 and 7.

Climatic conditions of the area are normally not as marked or severe as those prevalent east of the Continental Divide. The area lies west and south of the normal path of high and low pressures moving in from the north. This partially accounts for the more equable climate that is not subjected to marked and sudden changes. Ameliorating changes from low to mild temperatures occasionally occur during the winter as a result of chinook winds.

Based on climatalogical data9/ from three weather stations, within or adjacent to the area (Libby, Fortine and Pleasant Valley), the average annual temperature has been determined as 41.9° with seasonal averages of 41.2° for spring, 61.2° for summer, 42.1° for fall, and 22.7° for winter. The warmest month is July with an average temperature of 62.9° and the coldest is January with an average of 20.2°. Temperatures of 100° or over have been recorded during the months of July and August, with the highest being 109° in July, 1896. Low temperatures ranging below zero are common during each of the winter months. The lowest record was -51° at Pleasant Valley on December 18, 1924. The average length of the growing season is 105 days.

The average annual precipitation is 18.5 inches with seasonal averages of 3.79 inches for spring, 3.53 inches for summer, 4.41 inches for fall, and 4.16 inches for winter. Average snowfall for the three weather stations was: Libby 51.39 inches, Fortine 49.8 inches and Pleasant Valley 60.16 inches. Normally the heaviest snowfall occurs during the month of January.

Abnormally severe winter periods, with regards to snowfall and prolonged snow depth, have occurred in the area; however, no definite frequency pattern was established due to the lack of data. The occurrence of this type of winter is of great importance relative to big game movements and distribution as affected by the proposed water impoundment. This subject is discussed further in Appendix B.

9/ Climatic Summary of the U. S., Section 7, Western Montana. Climatological Data, Montana Sec., 1940, Vol. XLIII, No. 13.

Figure 6. Kootenai River valley just south of Five Mile Creek

Figure 7. Kootenai River valley near Stonehill

Area within flowage - Dam Site Mile 204.9

Tables 6 to 8 inclusive10/, and Figure 8 are based on the following assumptions: dam location, River Mile 204.9; maximum elevation of reservoir 2,459 feet above mean sea level. The map in Figure 8 shows the area of flowage.

Table 6. Area within flowage by class of land and ownership, Dam Site 204.9.

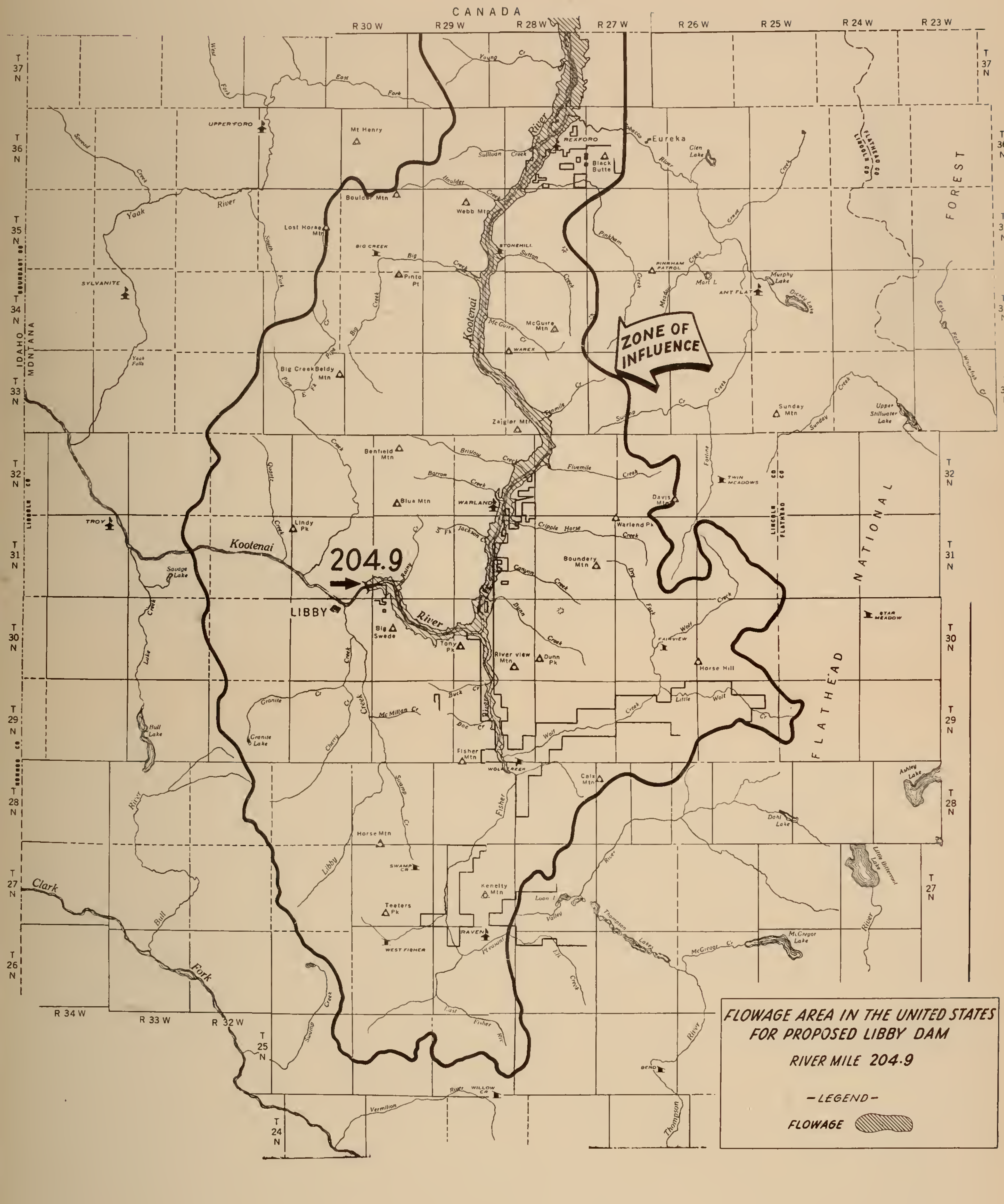
	Public	Private	Total
	Acres		
Water and river channel	4,252		4,252
Tillable land		2,053	2,053
Grazing and wasteland	284	15,617	15,901
Timberland	8,549	6,927	15,476
Townsites		220	220
Total	13,085	24,817	37,902

Table 7. Ownership of private timberland, grazing and wasteland in flowage, Dam Site 204.9.

	Grazing and wasteland	Timberland
	Acres	
J. Neils Lumber Company	223	3,900
Northern Pacific Railway	98	526
Other	15,296	2,501
Total	15,617	6,927

The terms "grazing and wasteland" and "timberland" as used in Tables 6 and 7 are based on the county assessor's classification. As other tables indicate, the great majority of this area is "forest" by Forest Survey definition.

10/ Tables 6 and 7 reprinted from U. S. F. S. report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953, p. 49. Acreages were determined by planimetering Army topographic maps.



CANADA
ZONE OF INFLUENCE
204.9
LIBBY
Kootenai
River
Eureka
REXFORD
TROY
IDAHO
MONTANA
FLATHEAD NATIONAL FOREST
FLOWAGE AREA IN THE UNITED STATES FOR PROPOSED LIBBY DAM
RIVER MILE 204.9
-LEGEND-
FLOWAGE

FIGURE 8

Acreages in Table 8 were determined by planimetering a vegetative cover-type map[11] of the proposed flowage basin. Proportionate type acreages are based on a total reservoir area of 38,169 acres for Dam Site 204.9. The photographs in Figures 9 to 18[12], inclusive, are representative of the vegetative cover types referred to in Table 8 and on the cover-type map referred to above. All type photographs were taken in or immediately adjacent to the proposed flowage area.

Table 8. Area within flowage by vegetative types,[13] Dam Site 204.9.

Type	Acres	Percent
Timber (ponderosa pine)	13,034	34.4
Timber (western larch--Douglas fir)	9,676	25.3
Timber (cedar-western larch-spruce)	887	2.3
Broadleaf trees (broadleaf)	2,373	6.2
Brush	590	1.5
Meadow	329	0.9
Grassland	2,184	5.7
Agriculture	2,422	6.3
Sand-gravel	1,088	2.8
Water	4,210	11.0
Industrial and townsites	237	0.6
Roads and railroads	1,139	3.0
Total	38,169	100.0

11/ Data for this map were obtained from cooperative field work conducted by the State Fish and Game Department and the U. S. Fish and Wildlife Service in the summer of 1953. The completed vegetative cover-type map is on record with the Montana Fish and Game Department.

12/ Photographs in Figures 9 to 18, inclusive, were taken, in part, by the Fish and Wildlife Service and reprinted by permission of that agency.

13/ Type descriptions are primarily those set forth by the River Basin Studies and exemplify the kind of big game habitat within the reservoir site, as follows:

(1) Timber (ponderosa pine). This type occupies the open southern and western exposures. Principal plant species are ponderosa pine, snowberry, kinnikinnick, spirea, bitterbrush (localized), serviceberry, Oregon grape, chokecherry, pinegrass, needlegrass, Idaho fescue, balsamroot, lupine and dogbane. This

Figure 9. Typical ponderosa pine timber type on south and west exposures along the Fisher River

Figure 10. Typical open ponderosa pine timber type on south and west exposures along the Kootenai River

Figure 11. Typical western larch-Douglas fir timber type on north and east exposures along Kootenai River

Figure 12. Typical cedar-western larch-spruce timber type found locally on west side of Kootenai River from Ural

Figure 13. Typical broadleaf vegetative type along the Kootenai River bottomlands

Figure 14. Typical brush vegetative type along the Kootenai River

Figure 15. Typical meadow vegetative type along the Kootenai River

Figure 16. Typical grassland vegetative type along the Kootenai River on the hillsides and in the bottomlands

Figure 17. Typical agricultural cover type along the Kootenai River

Figure 18. A combination of typical brush, agricultural and broadleaf cover types along the Kootenai River

13/, continued

type generally gives an aspect of ponderosa pine and is the principal winter-range type.

(2). Timber (western larch--Douglas fir). This plant association generally occurs on the northern and eastern exposures and is extremely dense and brushy. Principal plant species in this type are western larch, Douglas fir, birch, mountain maple, snowberry, spirea, rose, Oregon grape, serviceberry, dogwood, chokecherry and pinegrass.

(3). Timber (cedar-western larch-spruce). This particular type occurs along an approximately five-mile stretch of the Kootenai River, on the west side, near Ural. Plant species generally consist of cedar, western larch, Engelmann spruce, birch, mountain maple, willow, alder and quaking aspen.

(4). Broadleaf trees (broadleaf). The broadleaf-tree type is generally found growing along the river bottoms and especially on the islands. The cover in this type consists primarily of cottonwood, understoried with dogwood, willow, alder, chokecherry, snowberry and rose.

(5). Brush. The brush type is generally found on small bench tracts on the slopes. Plant composition varies accordingly with local environmental conditions. Some of the islands along the river are dominated by willows while the hillside types consist of either bitterbrush and serviceberry, or snowberry, ninebark, rose, mock orange, serviceberry and chokecherry. The understory of this type generally includes such plant species as bluegrass, downy chess, balsamroot, kinnikinnick and green lupine.

(6). Meadow. The meadow type is found along the river bottoms and the dominant plant species, in general, include bluegrass, redtop and yarrow.

(7). Grassland. The grassland type is located on hillsides and bottomland, and the plant species vary from annual to perennial grasses and weeds, such as bluegrass, downy chess, Idaho fescue, lupine and yarrow.

(8). Agriculture. The agricultural type occurs in small tracts within and adjacent to the river bottom. The principal crops consist of wheat, barley, oats, alfalfa, or pasture grasses such as smooth brome, timothy and orchard grass.

(9). Sand-gravel. The sand-gravel type is located along the Kootenai and Fisher Rivers, primarily at low water stage during the late summer and fall months.

13/, continued.

(10). Water. This type is self explanatory and includes only water areas of the Kootenai and Fisher Rivers and a few scattered glacial potholes.

(11). Industrial and townsites. This type is self explanatory and includes the towns of Warland and Rexford as well as the industrial areas of the Zonolite Mining Company, J. Neils Lumber Company (Rexford), and commercial gravel excavations.

(12). Roads and railroads. This type includes State Highway No. 37, the Great Northern railroad, the J. Neils Lumber Company's primary log hauling roads and major County and U. S. Forest Service access roads.

Area within Zone of Influence - Dam Site Mile 217.0

The Zone of Influence for dam site 217.0 includes a total of 704,845 acres of land area (before deduction of flowage) as shown in Figure 19, of which, over 90 percent is forested. Figures 3, 4 and 5 14/ show the general character of the land area, classified as to forest types, land use and ownership. (Through necessity, Figures 3, 4 and 5 depict only that area pertaining to the forest resource Zone of Influence; however this adequately suffices for the purpose intended here).

The extremities of the Zone of Influence were again based on deer herd movements in relation to the proposed impoundment area and the restoration of major transportation facilities. The construction of a dam at Mile 217.0 would be at a point of natural herd segregation, with negligible interherd movement from above or below the site.

The extension of the zone to include the lower Fisher River and Wolf Creek drainages was made solely on the basis of alternative plans, submitted by the U. S. Forest Service, for the restoration of the Great Northern Railroad. This is of essential concern relative to wintering herds in this area as will be discussed later. If it were not for this developmental feature the southern extremity for the zone would continue from River Mile 217.0 northeast along the Kootenai-Wolf Creek divide thereby excluding the Fisher River-Wolf Creek deer herd which is noted as one of the largest white-tailed concentrations in the state.

14/ Figures 3, 4 and 5 reprinted from the U. S. Forest Service report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953, pp. 54, 56 and 57.

Climatic and topographical data for this area are, in general, the same as previously discussed for the Zone of Influence for Site 204.9; the former area merely being the north and eastern portion of the latter.

Area within flowage - Dam Site 217.0

Tables 9, 10[15/] and 11, and Figure 19 are based on the following assumption: dam location, River Mile 217.0; maximum elevation of reservoir, 2,459 feet above mean sea level. The map in Figure 19 shows the area of flowage.

Table 9. Area within flowage by class of land and ownership, Dam Site 217.0.

	Public	Private	Total
	Acres		
Water and river channel	3,427		3,427
Tillable land		1,753	1,753
Grazing and wasteland	183	14,518	14,601
Timberland	7,495	2,642	10,137
Townsites		220	220
Total	11,105	19,133	30,238

Table 10. Ownership of private timberland, grazing and wasteland in proposed flowage, Dam Site 217.0.

	Grazing and wasteland	Timberland
	Acres	
J. Neils Lumber Company	223	1,380
Other	14,295	1,262
Total	14,518	2,642

15/ Tables 9 and 10 reprinted from the U. S. F. S. report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953, p. 51. Acreages were determined by planimetering Army topographic maps.

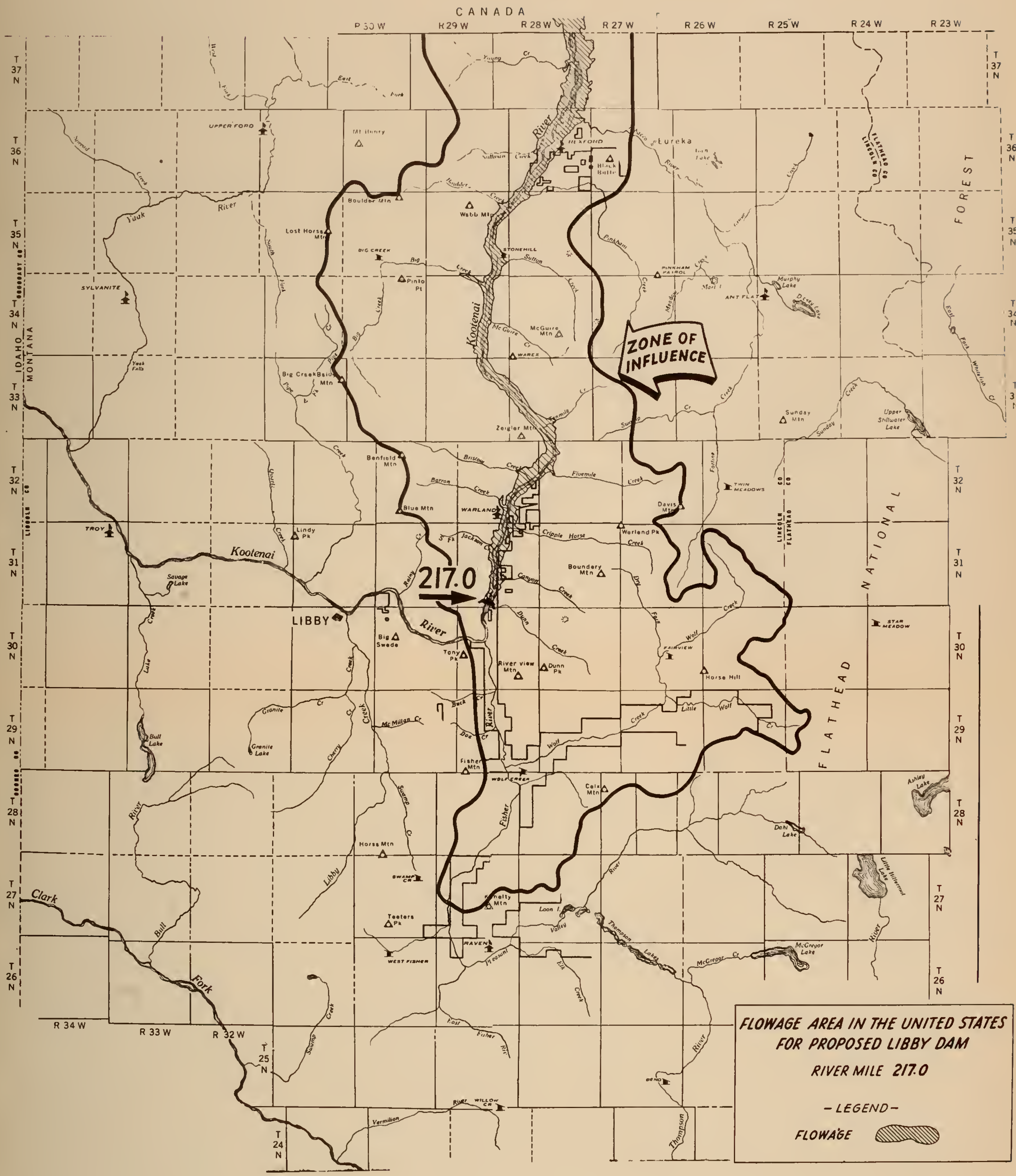

FLOWAGE AREA IN THE UNITED STATES
FOR PROPOSED LIBBY DAM
RIVER MILE 217.0
- LEGEND -
FLOWAGE
ZONE OF INFLUENCE
217.0
CANADA
IDAHO
MONTANA
FLATHEAD NATIONAL FOREST
LIBBY
TROY
Kootenai River
Clark Fork
Fisher River
Thompson River
Yaak River
Tobacco River
WARLAND
REXFORD
Eureka
Savage Lake
Bull Lake
Thompson Lakes
McGregor Lake
Little Bitterroot Lake
Ashley Lake
Upper Stillwater Lake
Murphy Lake
Dickey Lake
Granite Lake
Big Swede
Blue Mtn
Benfield Mtn
Boulder Mtn
Lost Horse Mtn
Davis Mtn
Werlend Pk
Boundary Mtn
River view Mtn
Dunn Pk
Tony Pk
Fisher Mtn
Calx Mtn
Horse Hill
Horse Mtn
Teeters Pk
Lindy Pk
Pinto Pt
Webb Mtn
McGuire Mtn
Zeigler Mtn
Sunday Mtn
Black Butte
UPPER FORD
SYLVANITE
BIG CREEK
STONEHILL
PINKHAM PATROL
ANT FLAT
TWIN MEADOWS
STAR MEADOW
FAIRVIEW
WOLF CREEK
SWAMP CR
WEST FISHER
RAVEN
WILLOW CR
LINCOLN CO
FLATHEAD CO
R 34 W
R 33 W
R 32 W
R 30 W
R 29 W
R 28 W
R 27 W
R 26 W
R 25 W
R 24 W
R 23 W
T 37 N
T 36 N
T 35 N
T 34 N
T 33 N
T 32 N
T 31 N
T 30 N
T 29 N
T 28 N
T 27 N
T 26 N
T 25 N
T 24 N

FIGURE 19

The terms "grazing and wasteland" and "timberland" as used in Tables 9 and 10 are based on the county assessor's classifications. As other tables indicate, the great majority of this area is "forest" by Forest Survey definition.

Acreages in Table 11 were determined by planimetering a vegetative cover-type map[16] of the proposed flowage basin. Proportionate type acreages are based on a total reservoir area of 30,247 acres for Dam Site 217.0.

Table 11. Area within flowage by vegetative cover types,[17] Dam Site 217.0.

Type	Acres	Percent
Timber (ponderosa pine)	10,076	33.3
Timber (western larch--Douglas fir)	6,647	22.0
Timber (cedar-western larch-spruce)	887	2.9
Broadleaf trees (broadleaf)	2,209	7.3
Brush	411	1.4
Meadow	303	1.0
Grassland	2,173	7.2
Agriculture	2,108	7.0
Sand-gravel	1,005	3.3
Water	3,373	11.1
Industrial and townsites	223	0.7
Roads and railroads	832	2.8
Total	30,247	100.0

16/ Data for this map were obtained from field work conducted in cooperation with the Fish and Wildlife Service in the summer of 1953. The completed vegetative cover-type map is on record with the Montana Fish and Game Department.

17/ Type descriptions are primarily those set forth by the River Basin Studies and exemplify the kind of big game habitat within the reservoir site. Note 13/ for the detailed type descriptions.

APPENDIX B. BIG GAME INVESTIGATION - DAM SITE 204.9

The impact of a dam at River Mile 204.9 upon the big game resources of Lincoln County, as resolved by the Montana Fish and Game Department, is presented in the following analysis. In appraising the impact only deer, elk and mountain sheep have been evaluated in this report. The effects upon moose, bear and mountain goats will be of little or no consequence.

Subdivision of area into management units.

To facilitate a clearer presentation and understanding of data, the Zone of Influence for Dam Site 204.9 has been subdivided into the following three distinct big game management units, as shown in Figure 20:

Management Unit	Total Acres
Libby	367,870
Fisher River-Wolf Creek	350,460
Jennings-Gateway	500,050

Subdivision of the area was made on the basis of natural and distinct segregation of wintering herds in as much as the availability of winter range is the limiting factor in maintaining big game populations. The proposed reservoir impact will vary by individual units, hence each has been analyzed separately.

Libby Management Unit.

In general, the unit consists of cut-over forest land with the exception of a few small, scattered bottomland ranches and the townsite of Libby. The terrain, as a whole, is mountainous with elevations from 2,000 to 6,000 feet, except in the Cabinet Range southeast of Libby. Here elevations extend up to approximately 8,700 feet. Principal drainages are Pipe Creek, Libby Creek and that portion of the Kootenai River from Jennings downstream to Kootenai Falls.

Average snow depths within the Unit vary from 6 inches along the Kootenai River to 18 inches south of Libby. However, with the occurrence of severe storms, snow accumulates to much greater depths. Temperatures drop to 30 degrees below zero, though seldom below a minus 10 degrees. The average winter temperature at night is about 10 degrees above zero and during the daylight hours about 32 degrees above zero.

Summer Range - deer and elk. The Libby Management Unit comprises

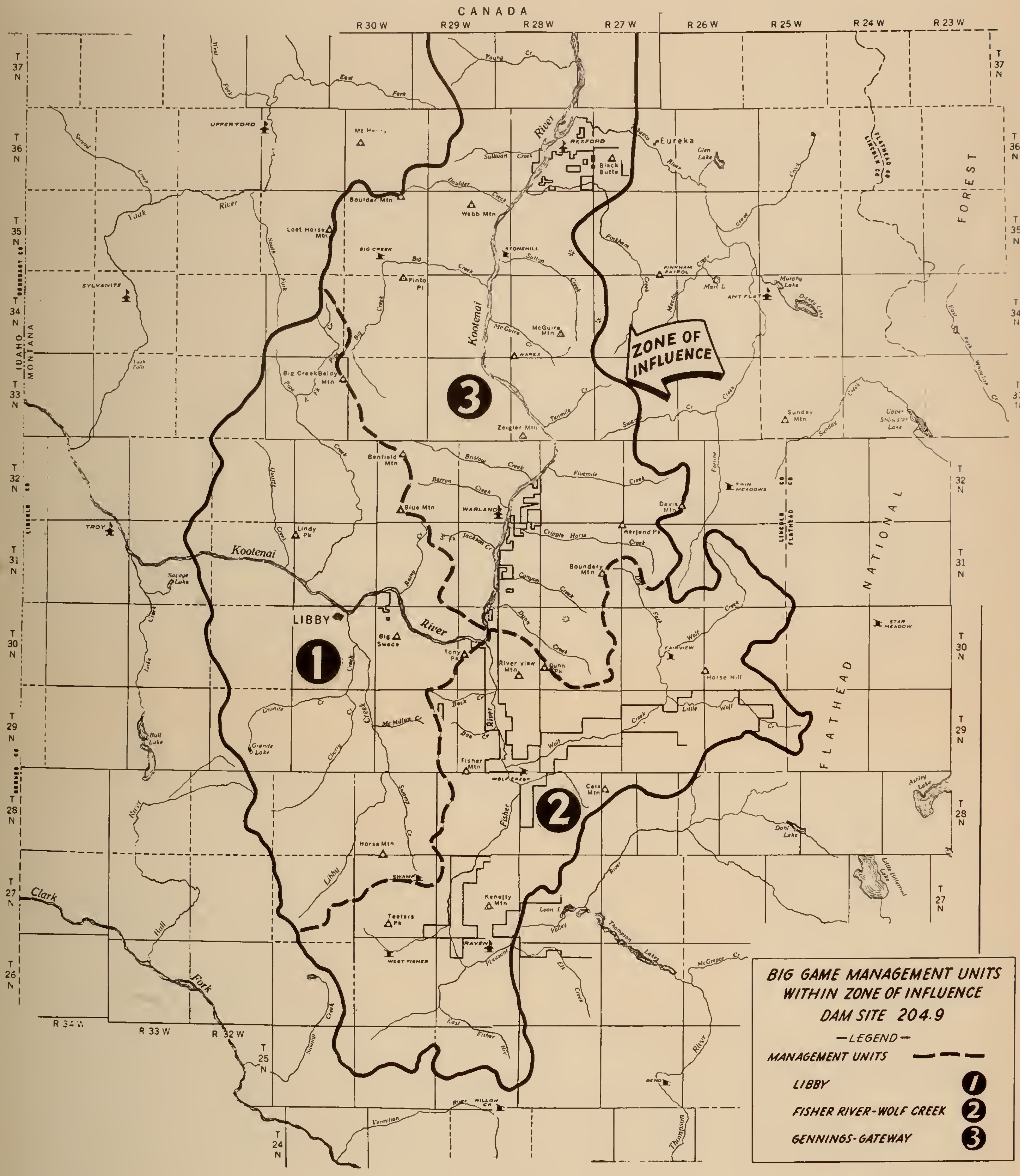

BIG GAME MANAGEMENT UNITS
WITHIN ZONE OF INFLUENCE
DAM SITE 204.9
—LEGEND—
MANAGEMENT UNITS
LIBBY
FISHER RIVER-WOLF CREEK
GENNINGS-GATEWAY
ZONE OF INFLUENCE
CANADA
IDAHO
MONTANA
FLATHEAD NATIONAL FOREST
LIBBY
Eureka
REXFORD
TROY
Kootenai River

FIGURE 20

a total land area of approximately 367,870 acres[18], all of which are classified as summer range for deer and elk. However, the greater majority of animals inhabit the north and east exposed slopes of dense timber during the summer months. In general, the range can be classified into four major vegetative types: (1) stream-bottom types consisting of broadleaf species such as cottonwood, birch, alder, dogwood and willow; (2) open ponderosa pine types on southern and western slope exposures, with a ground cover of various browse species such as serviceberry, chokecherry, snowberry and snowbrush; (3) dense Douglas fir-western larch-lodgepole types on northern and eastern slope exposures, with a ground cover of various browse species such as mountain maple, nannyberry, serviceberry, snowberry, rose and kinnikinnick; (4) open grassy or brushy hillsides with browse species such as bitterbrush (localized), mock orange, ninebark, serviceberry and chokecherry.

Deer and elk begin their annual spring migration or dispersion onto the summer ranges in late March or early April, depending primarily upon the existing conditions of snow depth on north and east exposures and at higher elevations. Movement off of these ranges toward the winter concentration areas generally begins in late October, again dependent upon climate. Early snow storms at higher elevations tend to activate the fall migration. The intensity of movement is proportional to the severity and duration of these storms.

Due to the general location, as well as the abundance and excellent condition of summer ranges within the Libby Management Unit, the construction of a dam at River Mile 204.9 would have no effect upon the normal activities of summering deer and elk populations.

Winter range - deer and elk. As previously stated, the amount of available winter range will control the number of big game animals that can be adequately maintained on a range area. The winter distribution of deer and elk herds within the Libby Management Unit is generally from stream bottom up to about 4,500 feet on the south and west exposures. However, during milder winters such as that of 1952-53 the animals will also utilize the north and east exposed slopes consisting of a dense Douglas fir-western larch-lodgepole pine type.

Above the 4,000 foot elevation mean temperatures are normally well below freezing during the winter months. As a consequence all precipitation accumulates in the form of snow. North and east slope exposures extend the range of this micro-climate well below 4,000 feet resulting in excessive snow accumulation.

18/ All big game winter range and management unit acreages appearing hereafter within the contents of this report have been derived by planimetering specific areas plotted on U. S. Forest Service maps - $\frac{1}{2}$ inch to the mile scale; unless stated otherwise.

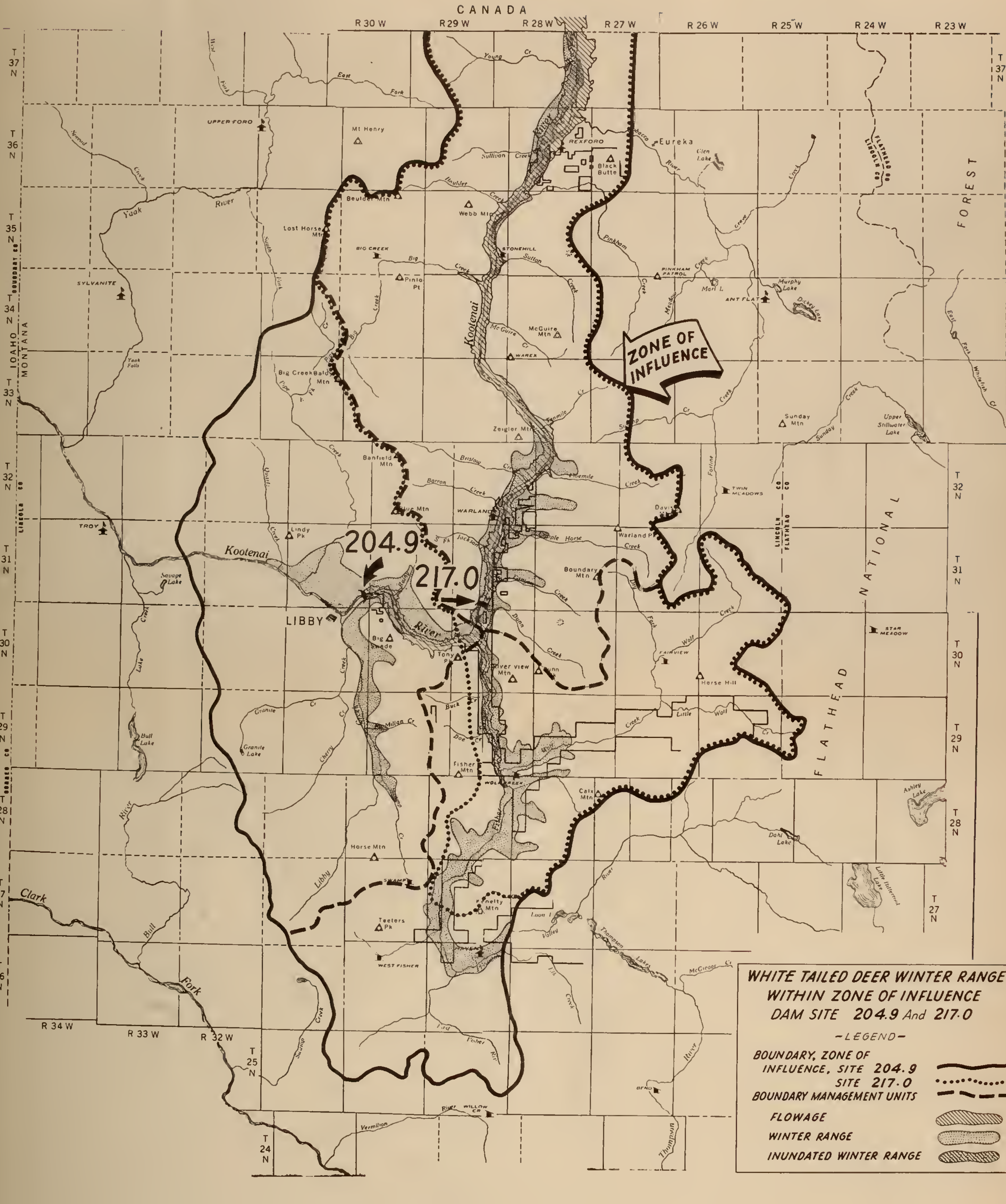
Various small areas within the Unit that might normally support wintering animals are unfit for use because of dense vegetative cover of lodgepole pine reproduction which has become established as a result of fires. Other areas such as the extensive "flats" between Bobtail and Pipe Creek and those between the Cabinet Mountains and the McMillan Range, even though abundantly vegetated with desirable deer browse such as snowbrush, do not support a large number of animals during the winter months. At this season the sun's angle of inclination is low. Consequently the absorption of heat is at a minimum on these horizontal land areas and the snow tends to lay deeper than on the south and west exposures. This discourages utilization of the "flats" by deer.

The winter deer and elk range will normally fall into three general forest types: (1) stream-bottom types consisting of broadleaf trees such as cottonwood, birch, alder, dogwood and willow; (2) open ponderosa pine types on the south and west exposed slopes with a ground cover of various browse species such as snowbrush, serviceberry and chokecherry; and (3) open grassy and brushy ridge and slope types with browse species such as ninebark, mock orange, serviceberry and chokecherry.

Wintering ranges on this Unit are restricted primarily to two areas; (1) the south and southwest exposures along the north side of the Kootenai River from Jennings downstream to Kootenai Falls, and (2) the west and southwest slopes of the McMillan Mountains from Libby southeast to the Fisher River. Range elevations vary from approximately 2,000 to 4,500 feet on both areas. The maps in Figures 21, 22 and 23 show the white-tailed deer, mule deer and elk winter range areas, respectively, for the Unit. Deer and elk use on the winter ranges usually extends from about December 15 to March 31, or approximately $3\frac{1}{2}$ months. However, the areas are utilized to some extent by animals the year around, more especially by deer.

On the generally west and southwest slopes of the McMillan Range deer and elk normally utilize a total land area of approximately 26,010[19/] acres as winter range. White-tailed deer forage over 12,340 acres of the total area, mule deer over 12,590 acres, and elk over 7,730 acres, Table 12. Due to the wintering habits of these species 6,450 acres or 24.8 percent of the total area is classified as mixed range, utilized by variable species combinations. Table 13 shows the range use by species and species combinations. This data furnishes a basis not only for analyzing the degree of interspecies competition for available winter range but also for determining proper management applications toward the desired or necessary species-range balance.

19/ The extremities of winter ranges in Lincoln County fluctuate periodically in direct relation to snowfall and existing snow depth. For this reason all winter range figures were derived on the basis of a normal or average winter in this area and are subject to acreage fluctuation.


WHITE TAILED DEER WINTER RANGE
WITHIN ZONE OF INFLUENCE
DAM SITE 204.9 And 217.0
-LEGEND-
BOUNDARY, ZONE OF INFLUENCE, SITE 204.9
SITE 217.0
BOUNDARY MANAGEMENT UNITS
FLOWAGE
WINTER RANGE
INUNDATED WINTER RANGE
ZONE OF INFLUENCE
204.9
217.0
CANADA
IDAHO
MONTANA
FLATHEAD NATIONAL FOREST
LIBBY
Eureka
REXFORD
TROY
Kootenai
River
R 30 W
R 29 W
R 28 W
R 27 W
R 26 W
R 25 W
R 24 W
R 23 W
R 34 W
R 33 W
R 32 W
T 37 N
T 36 N
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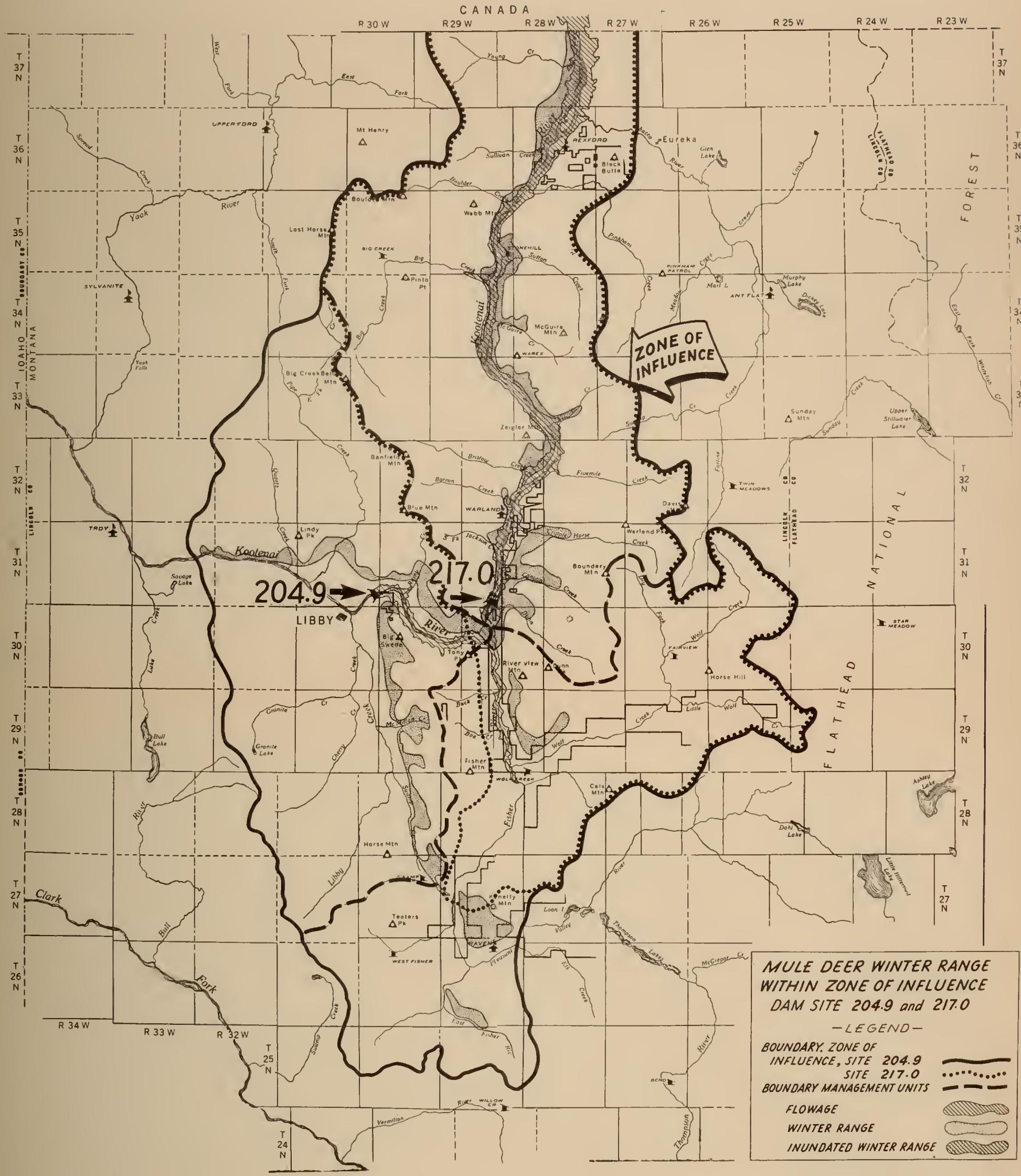
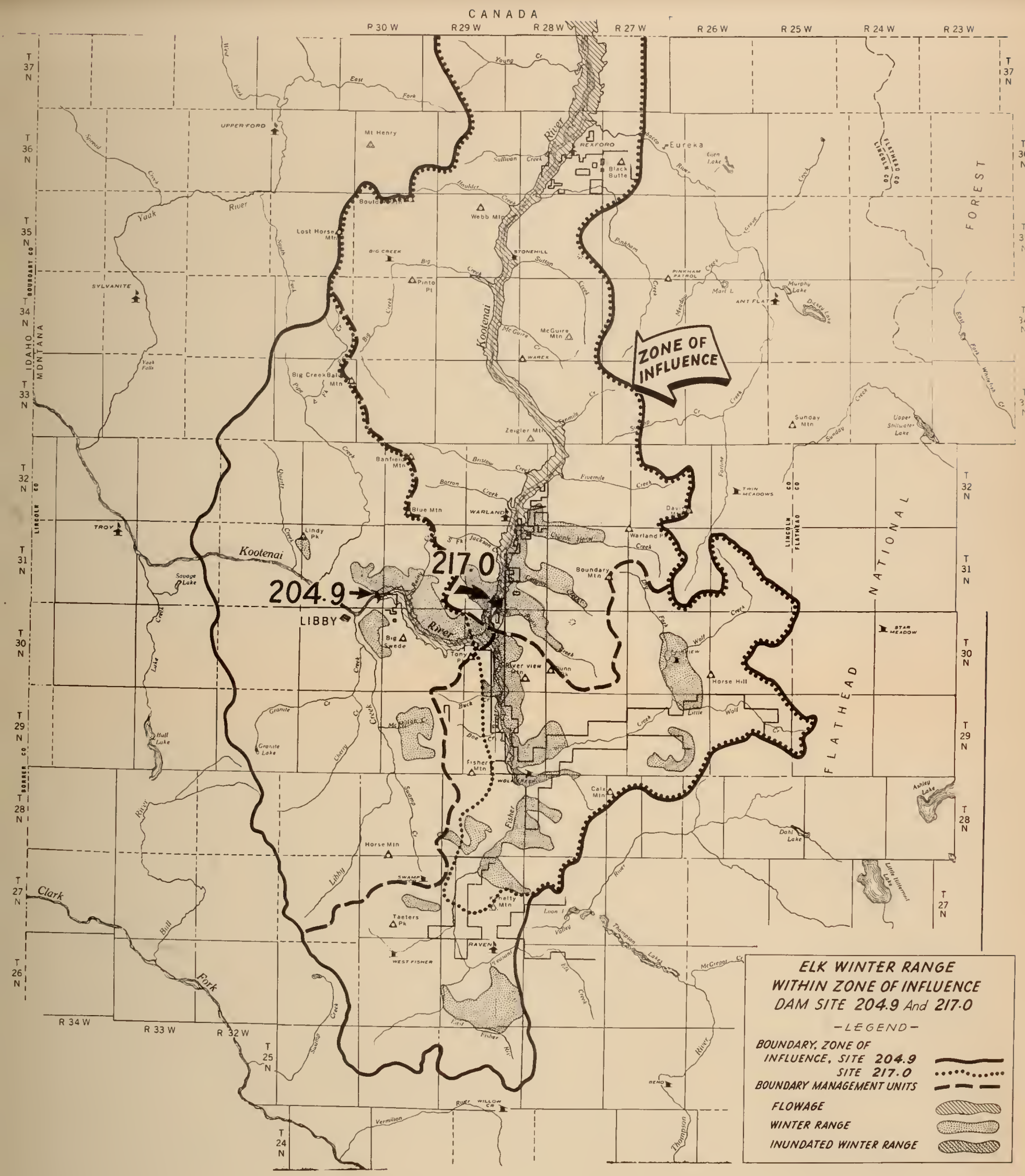


MULE DEER WINTER RANGE WITHIN ZONE OF INFLUENCE DAM SITE 204.9 and 217.0

—LEGEND—

- BOUNDARY, ZONE OF INFLUENCE, SITE 204.9
- SITE 217.0
- BOUNDARY MANAGEMENT UNITS
- FLOWAGE
- WINTER RANGE
- INUNDATED WINTER RANGE

FIGURE 22


CANADA
R 30 W
R 29 W
R 28 W
R 27 W
R 26 W
R 25 W
R 24 W
R 23 W
T 37 N
T 36 N
T 35 N
T 34 N
T 33 N
T 32 N
T 31 N
T 30 N
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T 27 N
T 26 N
T 25 N
T 24 N
IDAHO
MONTANA
BOUNDARY CO
LINCOLN CO
FLATHEAD CO
LINCOLN CO
BONNER CO
ZONE OF INFLUENCE
217.0
204.9
LIBBY
Kootenai
River
Yaak
River
Clark
Fork
FOREST
NATIONAL
FLATHEAD
UPPER FORD
Mt Henry
REXFORD
Eureka
Black Butte
Webb Mtn
Lost Horse Mtn
BIG CREEK
STONEHILL
Pinto Pt
SYLVANITE
PINKHAM PATROL
Murphy Lake
ANT FLAT
McGuire Mtn
WAREK
Big Creek Baldy Mtn
Zeigler Mtn
Sunday Mtn
Upper Shillwater Lake
Banfield Mtn
Blue Mtn
WARLAND
TWIN MEADOWS
TROY
Lindy Pk
Warland Pk
Boundary Mtn
Savage Lake
Big Swede
Tony Pk
River view Mtn
Dunn Pk
Horse Hill
STAR MEADOW
Hull Lake
Granite Lake
McMillan Pk
Fisher Mtn
WOLF CREEK
Calx Mtn
Ashley Lake
Dahl Lake
Little Interment Lake
Horse Mtn
SWAMP
Shelty Mtn
Taelers Pk
RAVEN
WEST FISHER
Loon Lake
Thompson Lakes
McGregor Cr
BENO
RIVER WILLOW CR
Vermilion
Thompson
ELK WINTER RANGE
WITHIN ZONE OF INFLUENCE
DAM SITE 204.9 And 217.0
-LEGEND-
BOUNDARY, ZONE OF INFLUENCE, SITE 204.9
SITE 217.0
BOUNDARY MANAGEMENT UNITS
FLOWAGE
WINTER RANGE
INUNDATED WINTER RANGE

FIGURE 23

Table 12.[20/] Species use of the total winter area (26,010 acres) on the McMillan Range.

Species	Acres	Percent of Total Area
White-tailed deer	12,340	47.4
Mule deer	12,590	48.4
Elk	7,730	29.7

Table 13. Species and interspecies use on winter areas of the McMillan Range.

Species	Acres	Percent of Total
White-tailed deer (only)	8,680	33.4
Mule deer (only)	8,550	32.8
Elk (only)	2,330	9.0
White-tailed deer and mule deer	1,050	4.0
White-tailed deer and elk	2,410	9.3
Mule deer and elk	2,790	10.7
White-tailed deer, mule deer and elk	200	0.8
Total	26,010	100.0

The deer herds that annually migrate onto the area are principally from the summer ranges on the east slopes along the central portion of the Cabinet Mountains as shown in Figure 21. A great many of these animals are merely transients and continue east over the divide and into the Fisher River-Wolf Creek country to winter. As a result of this, relatively small herds occupy the former range. A good majority of the elk are year around residents of the general area and the remainder are believed to migrate in from the south central portion of the Cabinets. However, little is known to date on the elk migration behavior within Lincoln County.

Range conditions are better here than in most other sections, no doubt due, in part, to the relatively light animal pressure as well as the proximity of the area to Libby. The principal browse species found on the range are serviceberry, chokecherry, snowbrush, mountain maple,

20/ Acreages are based on the total area each species normally forages over and do not take into consideration mixed or overlapping ranges.

snowberry, kinnikinnick, nannyberry, ninebark, Oregon grape, dogwood, alder, willow and rose.

The other winter area of concern on the Libby Unit is that located adjacent to the north side of the Kootenai River from Jennings downstream to Kootenai Falls. Here the deer and elk normally utilize a total land area of approximately 27,570[21] acres as winter range; shown in Figures 21, 22 and 23. White-tailed deer forage over 17,440 acres of the wintering area, mule deer over 12,760 acres, and elk over 14,570 acres, Table 14. Fourteen thousand sixty or 51.0 percent of the total acreage is classified as mixed range, utilized by variable species combinations of deer and elk. Table 15 shows the range use by species and species combinations.

Table 14.[22] Species use of the total winter range area (27,570 acres) on the Kootenai River slopes from Jennings to Kootenai Falls.

Species	Acres	Percent of Total Area
White-tailed deer	17,440	63.2
Mule deer	12,760	46.3
Elk	14,570	52.8

Table 15. Species and interspecies use on winter ranges of the Kootenai River slopes from Jennings to Kootenai Falls.

Species	Acres	Percent of Total
White-tailed deer (only)	6,380	23.2
Mule deer (only)	4,990	18.2
Elk (only)	2,150	8.0
White-tailed deer and mule deer	1,640	5.9
White-tailed deer and elk	6,270	22.7
Mule deer and elk	2,990	10.9
White-tailed deer, mule deer and elk	3,150	11.1
Total	27,570	100.0

21/ All winter range figures were derived on the basis of a normal or average winter in this area and are subject to acreage fluctuation, dependent upon prevailing snow conditions.

22/ Acreages are based on the total area each species normally forages over and does not take into consideration mixed or overlapping ranges.

Elk in this area generally utilize the upper limits of their range throughout a greater part of the winter. However, they periodically move down to the lower elevations for short intervals. Range use at the lower elevations becomes prevalent with the onset of severe periods of excessive snow accumulation.

The deer and elk herds that annually migrate onto the Kootenai slopes are primarily from the summer ranges of the Pipe Creek drainage (note Figure 2). As on the McMillan winter ranges this area is also an access route for many transient animals migrating into the Fisher River-Wolf Creek country for the winter. However, here the continued migration is restricted primarily to white-tailed deer as only a relatively few mule deer and an occasional elk are known to cross into the Fisher drainage. A great many of the former species move across the Kootenai slopes and funnel into the major crossing point of the Kootenai River located at Jennings. Upon swimming the river the animals continue on up the Fisher drainage to the concentration areas.

Winter range conditions are considered as fair to overused. In addition to the regular key species of browse as listed for the McMillan Range, bitterbrush and mock orange are also present on the north side of the Kootenai River from Rainy Creek to the river bend at Jennings; known locally as the Horse Range. An isolated patch of big sage is also present on the Horse Range.

Wintering Populations - deer and elk. The most intensive winter population studies on the Libby Management Unit were made by Zajanc (1947-48) and Schmautz (1948-49 and 1949-50). In the spring of 1950 the white-tailed and mule deer populations inhabiting the winter ranges were estimated to be 1,600 and 400, respectively. The Fish and Game Department and U. S. Forest Service estimated the herds at 1,000 and 400, respectively, for the year 1954. A greater part of this deer population utilizes the winter range area on the Kootenai River slopes from Jennings to Kootenai Falls. The number of elk wintering on the Unit is not known, however, from field observations there is possibly a total of 100 to 150 animals. Again, as in the case of deer, the greater number are found on the Kootenai River slopes, primarily that portion known as the Horse Range.

Hunter harvest. Little can be said concerning the numbers of big game that are harvested on the Unit each year. In analyzing the resource relative to the proposed dam construction at River Mile 204.9 it was noted that the basis for findings were in relation to winter ranges and populations. During the annual big game hunting seasons the deer and elk are normally still on their summer ranges. Hence, it is virtually impossible to apportion the total area kill to the proper wintering unit considering the migratory habits of the animals.

As was discussed earlier, the annual deer harvest for Lincoln County, as a whole, has been very light. It was estimated as 5.7 percent of

the fall population in 1947. Present range conditions in conjunction with winter population data invariably points to the need of an increased deer harvest over most of the county.

During the 1953 and 1954 hunting seasons approximately 45 to 50 bull elk were harvested in Lincoln County. With this harvest the population is considered on the increase. At the present time it appears that the interspecies competition for range between elk and white-tailed deer, the latter being the desired species of the County, has not begun to show. However, it is felt that the competitive range relationship should be closely observed in the future so as to assure the continued use of the area as deer winter range. In the event that winter elk foraging begins to render the range unsuitable for the normal continuance of existing deer populations, alleviating measures should be undertaken immediately. The necessary action would be to properly reduce the former species in numbers or remove them entirely, if deemed necessary, from the winter range area in question.

Impact of the proposed Libby Dam on deer and elk populations within the Libby Management Unit. The construction of a dam at River Mile 204.9 can activate various direct and indirect influences on big game, realized throughout the entire Libby Unit. In analyzing the many probable effects that could be incurred it was found that precise conclusions were not predictable in most instances. Animal behavior response to habitat changes would be controlled or influenced by many variables of an undeterminable nature such as climatic conditions, food availability and herd population pressure.

As previously pointed out, summer range does not constitute a problem in relation to the proposed reservoir. .The primary concern is the degree of effect upon existing winter ranges and the inhabiting populations. Within the Unit there is a total area of approximately 53,580 acres of land classified as normal deer and elk winter range, Figures 21, 22 and 23. Of this total acreage white-tailed deer utilize 29,780 acres, 2,200 acres or 7.4 percent of which will be inundated; mule deer utilize 25,360 acres, 260 acres or 1.0 percent of which will be inundated; and elk utilize 22,290 acres, 1,690 acres or 7.2 percent of which will be inundated, as shown in Table 16. Twenty thousand five hundred acres or 38.3 percent of the total winter area is classified as mixed range, utilized by species combinations, of which 1,690 acres or 8.2 percent will be inundated. Species and interspecies use on the winter ranges and the proportionate acreages to be inundated are shown in Table 17.

Due to the complexities involved in evaluating the impact upon the big game resources it has been necessary to analyze each of the two range areas on the Libby Unit separately. The adverse effects of winter range loss from the proposed reservoir will be primarily restricted to that portion of the range lying adjacent to the north side of the Kootenai River.

Table 16.[23/] Species use of the total winter range area (53,580 acres on the Libby Management Unit and the proposed range reduction by inundation.

Species	Total Acres	Proposed Acres Inundated	Percent of Range Use Reduction
White-tailed deer	29,780	2,200	7.4
Mule deer	25,360	260	1.0
Elk	22,290	1,690	7.6

Table 17. Species and interspecies use on winter ranges of the Libby Management Unit and proposed portions to be inundated.

Species	Total Acres	Acres Inundated	Percent of Total Area
White-tailed deer (only)	15,060	510	3.4
Mule deer (only)	13,540		
Elk (only)	4,480		
White-tailed deer and mule deer	2,690		
White-tailed deer and elk	8,680	1,430	16.5
Mule deer and elk	5,780		
White-tailed deer, mule deer and elk	3,350	260	7.8
Total	53,580	2,200	4.1

Of the 2,200 total acres of habitat to be inundated, 1,690 acres or 76.8 percent will be lost on this area. The total wintering area on the McMillan Range, 26,010 acres, will be reduced by only 510 acres or 2.0 percent whereas the total area on the Kootenai slopes, 27,570 acres, will be reduced by 1,690 acres or 6.1 percent. The combined range loss will be 4.1 percent, as shown in Table 17.

23/ Acreages are based on the total area that each species forages over and do not take into consideration mixed or overlapping ranges.

The foregoing figures have shown that on the Kootenai slopes the proposed inundation will reduce the total white-tailed deer range of 17,440 acres by 1,690 acres or 9.7 percent, the total mule deer range of 12,770 acres by 260 acres or 2.0 percent, and the total elk range of 14,560 acres by 1,690 acres or 11.6 percent. The acreage to be lost by inundation consists primarily of bottom land only lightly used by deer and a few elk during normal winters.

On the basis of this it appears that during the course of normal winters the total loss of winter range through flooding would not constitute a serious problem. However, during periods of severe storms and excessive snow accumulation white-tailed deer, in particular, are forced into the relatively level bottom lands and off the steep slopes. The bottom lands then become essential to the continued welfare of the white-tailed deer herds. For this reason an evaluation of impoundment effects must be made on the basis of conditions that prevail during the occurrence of critical periods. Figure 24 denotes the condition of excessive snow accumulation as compared to that of a normal winter as shown in Figures 25 and 26.

Figure 24. Occurrence of excessive snow depth on the winter big game ranges of Lincoln County, Montana.

Figure 25. Normal snow depth on the winter big game ranges of Lincoln County, Montana

Figure 26. Normal snow depth on white-tailed deer winter range in open ponderosa pine vegetative type

With an excessive accumulation of snow the animals descend to the relatively flat bottomlands for purposes of continued mobility in search of food and maintainance of body warmth. The occurrences of these critical conditions have been recorded for the winters of 1941-42, 1944-45, 1946-47 and 1953-54. Data was not obtained for the years prior to 1940 though severe storms were known to have taken place. During the critical period in the winter of 1953-54 (mid-January to mid-Fibruary 1954) field studies indicated that the white-tailed deer herds on the Unit were forced to restrict their range by as much as 40-60 percent of that normally utilized. Elk, in general, descended to the lower bench lands and only a few animals moved on down into the extreme bottoms. Mule deer, in general, remained on the higher ridges and benches where they were able to maintain open trails through the deep snow.

With the loss of essential bottomland, ice formation on the reservoir would offer the only compensation for white-tailed deer herds seeking flat areas for movement. Even though the animals could move along the fringes of the frozen impoundment, food availability would be at a minimum. Complications would be further aggravated by reservior draw-down which occurs at this time of year. The lowered water level would not only extend the distance to available food but it would also provoke an added hazard through the presence of shelf ice and steeply sloping ice blocks. Under such an adverse combination of conditions a prolonged period of deep snow could very well induce a tremendous herd loss through winter starvation.

To approach the problem of essential range loss by reducing the populations in direct proportion would not be practical. For this approach a uniform distribution of animal units per range unit must necessarily be assumed and such a condition does not exist. This prohibits recommendations for a specified herd reduction. However, it is apparent that the herds utilizing the winter range area north and adjacent to the Kootenai River will have to be reduced, though to an unpredictable level. The total population to be maintained must be in relation to conditions that prevail during critical periods. This will necessitate full consideration being given not only to known animal behavior during such periods but also to probable changes in behavior response that can arise through impoundment. Many possible animal adjustments, such as the shifting of herds to other ranges or severe concentrations on localized areas, are unpredictable. In any event the presence of these complex probabilities to be provoked by dam construction will be detrimental to white-tailed deer populations.

The impact of flooding on mule deer has been considered as insigificant due to their winter ranging habits, as formerly pointed out. Elk tend to follow the same general pattern of movement as do the white-tailed deer in relation to severe climatic conditions. In as much as the latter is the desired species an adjustment for range loss should be made in favor of the deer herd welfare. For this reason it is felt that the existing elk populations should be closely observed and either reduced accordingly or removed once competative

winter foraging endangers the continued existence of the white-tailed deer.

Another aspect to consider relative to the proposed reservoir is the major white-tailed deer migration crossing at Jennings. Under present conditions the deer swim the Kootenai River, a distance of 200-250 yards, to gain access to the winter ranges in the Fisher River area and also in migrating back to the summer ranges. The presence of impoundment would increase the water or swimming distance to a maximum of approximately three-fourths of a mile, dependent upon the amount of reservoir draw-down. If the inherent instinct to migrate to a certain area is great enough within the deer then the reservoir would not be an introduced barrier. However, lacking this instinct the increased water area would no doubt stop future migration into and out of the Fisher River at this point. Assuming that attempted migration would continue it is well to point out the added hazard of ice formation on the reservoir; a condition that normally does not exist on the river during the migratory peaks. Shoreline ice along the reservoir would tend to form earlier and break up later than on the river. This condition, dependent on weather factors could result in the loss of many deer that would be unable to regain land should they break through the ice.

The proposed reservoir impact on this established migration route is of great importance relative to herd-range adjustments. However, due to the variabilities involved as well as the limitation of factual data a reliable evaluation of the effect was not possible for this report. It can be concluded though, that within all probability the impact will be an added detriment to the white-tailed deer herds.

A factor of impact on the big game resource other than the direct loss of range by inundation will be the necessitated restoration of the Great Northern Railroad from Libby to Stryker. Under present conditions the railroad takes substantial tolls from the deer population each winter in areas of concentration. This is especially true during severe storms when the animals are forced down to the lower elevations where they move onto the cleared tracks. They are then reluctant to move back into the deep snow and away from the hazard of approaching trains.

Alternative relocation plans for the Great Northern have been suggested by the U. S. Forest Service. These plans are shown in Figure 34 for Dam Site 204.9. As indicated the railroad would be rerouted along the lower limits of the McMillan winter range area. However, in view of the relatively small wintering populations on this area it is felt that the railroad would not constitute a serious detrimental problem.

Fisher River-Wolf Creek Management Unit

Nearly the entire Unit, Figure 20, is classified as forest land, with the exception of a few widely scattered and small ranches. Elevations vary from approximately 2,500 feet to 6,000 feet, with the exception of the portion included in the Cabinet Mountain Range, where peaks are slightly over 7,000 feet high. The principal drainages of concern are Wolf Creek and the Fisher River.

Snow depths vary greatly. In the upper Fisher River they may reach 3 or 4 feet along the bottoms, tapering off on the south and west exposed slopes. Along the lower Fisher River depths range from 12 to 20 inches in the bottoms down to 3 to 6 inches on the south and west exposed slopes. Temperatures also vary widely. The minimums for example, range from 20 to 22 degrees above zero in November down to 30 degrees below in January and February. However, normally the temperature seldom drops below minus 10 degrees.

Summer range - deer and elk. The Fisher River-Wolf Creek Management Unit comprises a total land area of 350,460 acres, all of which is classified as summer range for deer and elk. However the great majority of animals inhabit the north and east slopes of dense timber during the summer months.

In general, the summer range can be classified into four major vegetative types: (1) stream-bottom types consisting of mixed broadleaf and conifer species such as cottonwood, birch, alder, dogwood, willow, Douglas fir and western larch; (2) open ponderosa pine types on the southern and western slope exposures with a ground cover of various browse species such as serviceberry, chokecherry, snowberry, Oregon grape, spirea and snowbrush; (3) dense Douglas fir-western larch-lodgepole pine types on northern and eastern slope exposures, with a ground cover of various species such as mountain maple, nannyberry, serviceberry, snowberry, rose and kinnikinnick; (4) open grassy or brushy hillsides with browse species such as mock orange, ninebark, serviceberry and chokecherry.

Deer and elk begin their annual migration or dispersion off the winter ranges and onto the summer areas in late March or early April, depending primarily on the existing conditions of snow depth on north and east slopes and at higher elevations. Movement off of these ranges toward the winter concentration areas generally begins in late October, again dependent upon prevailing snow conditions. Early snow storms at higher elevations tend to activate the fall migration. The intensity of movement is proportional to the severity and duration of these storms.

Throughout the Unit there is an abundance of excellent summer range. Hence the construction of a dam at River Mile 204.9 would have no impact upon the normal activities of summering deer and elk populations.

Winter range - deer and elk. Again it is essential to note that the amount of available winter range will control the number of big game animals that can be properly maintained within a range area. This fact is outstanding on the Fisher Unit in as much as one of the largest white-tailed deer concentrations in the State winters here.

The elevational distribution of wintering herds is generally from stream bottom up to about 4,500 feet on the south and west open yellow pine exposures. During milder winters such as occured in 1951-52 the deer and elk herds will, to some extent, utilize the north and east exposures consisting of a dense Douglas fir-western larch-lodgepole pine type. Above the 4,000 foot elevation mean temperatures are well below freezing during the winter months with all precipitation accumulating in the form of snow. North and east exposures extend the range of this micro-climate well below 4,000 feet which results in an excessive snow accumulation.

The winter ranges within the Unit will normally fall into three general forest types: (1) stream-bottom types consisting of mixed broadleaf and conifer species such as cottonwood, birch, alder, dogwood, willow, Douglas fir and western larch; (2) open ponderosa pine types on the south and west exposed slopes with a ground cover of various browse species such as chokecherry, serviceberry, spirea, snowbrush and snowberry; and (3) open grassy and brushy ridge and slope types with browse species such as mock orange, ninebark, serviceberry and chokecherry. The first type is generally only lightly used during normal winters.

Wintering areas for the big game species in question are primarily restricted to the south and west exposures along the Fisher River and Wolf Creek with additional small range areas extending up the lateral drainages. The maps in Figures 21 to 23, inclusive, show the white-tailed deer, mule deer and elk winter ranges, respectively.

Within the Unit deer and elk normally utilize a total land area of approximately 74,230[24/] acres as winter range. White-tailed deer forage over 35,120 acres of the total area, mule deer over 12,700 acres and elk over 49,280 acres. Twenty thousand nine hundred and twenty acres or 28.2 percent of the total area is classified as mixed range, utilized by variable species combinations. Table 18 shows the range use by species and species combinations. The data in this table indicates the degree of interspecies competition for available winter range.

24/ The extremities of winter ranges in Lincoln County fluctuate periodically in direct relation to snowfall and existing snow depth. For this reason all winter range figures were derived on the basis of a normal or average winter in this area and are subject to acreage fluctuation.

Table 18. Species and interspecies use on the winter ranges within the Fisher River-Wolf Creek Management Unit.

Species	Acres	Percent of Total
White-tailed deer (only)	17,760	23.9
Mule deer (only)	6,220	8.4
Elk (only)	29,330	39.5
White-tailed deer and mule deer	970	1.3
White-tailed deer and elk	14,440	19.5
Mule deer and elk	3,560	4.8
White-tailed deer, mule deer and elk	1,950	2.6
Total	74,230	100.0

Elk generally utilize the upper limits of their ranges throughout the greater part of a normal winter, Figures 27a and 27b. However, they have been observed feeding at lower elevations from time to time for short intervals. With the onset of critical winter periods when there is an excessive accumulation of snow both the white-tailed deer and elk are forced off the steep slopes and into the valley bottoms, more especially along the lower Fisher River. Figures 24 and 28 denote the occurrence of excessive snow depth as compared to that of a normal winter as shown in Figures 25, 26 and 29.

During a critical period occuring in late January and early February 1954 the Montana Fish and Game Department conducted a study in the lower Fisher River area to determine the extent of range use following severe snow storms. This study brought out the following information. During normal winters, white-tailed deer utilize approximately 28,160 acres of winter range (along the lower Fisher River) consisting of stream bottoms, benches and south and west exposed slopes. With the onset of severe periods of deep snow the animals are forced off the slopes and compelled to restrict their range to a total area of approximately 10,750 acres, consisting of only stream bottoms and lower benches. This amounts to a 62 percent forced range reduction during such periods. Even in the bottoms animal mobility was greatly inhibited, often confined to movement along the river ice. To further provoke this critical deer situation it was found that the entire elk population was also forced into the bottoms. Here they competed directly with the former species for available food. From this it can readily be seen that if such conditions were prolonged for a lengthy period the result to the deer herds could be devastating.

Figure 27a. High south and west exposures utilized by elk on lower Fisher River during normal winters

Figure 27b. High south and west exposures utilized by elk on lower Fisher River during normal winters

Figure 28. Excessive snow accumulation on critical white-tailed deer winter range - lower Wolf Creek area

Figure 29. Normal winter conditions on white-tailed deer winter range - lower Fisher River area

Animal use on the winter areas generally extends from about December 15 to March 31, or approximately 3½ months. However, the areas do get some year around use. The deer herds that annually migrate into the winter area are from great expanses of outlying summer range areas, namely: the upper Wolf Creek drainage; the West and East Fisher drainage; east slopes of the lower Cabinet Mountain Range; the McMillan-Lower Fisher divide; the lower Fisher-Pleasant Valley divide; and areas immediately north of the Kootenai River from Jennings downstream to about Pipe Creek. Figure 2 shows the routes of deer migration and the tremendous expanse of summer range for which the Fisher River-Wolf Creek Unit is the wintering area.

The majority of the elk are believed to be year around residents of the general vicinity or adjacent summer ranges, with the exception of those that migrate onto the lower Fisher River slopes from the summer ranges around Horse Mountain. Little is known to date in relation to seasonal elk movements.

Winter range conditions are as a whole extremely poor, more especially on the lower Fisher River-Wolf Creek area. Such a seriously overutilized range condition can be primarily attributed to the intensive past and present winter use by overly large concentrations of white-tailed deer. Other factors that have directly or indirectly attributed to the depleted ranges are the establishment and maintainance of the Wolf Creek Game Preserve from 1923 to 1944 and the heavy overgrazing by domestic stock prior to 1936. As early as the mid 1930's game studies noted the overutilized condition of the lower Fisher River-Wolf Creek winter ranges. From field observations the most critical point of overuse is on the Wolf Creek drainage with conditions improving slightly to the north and to the south. In many instances not only the key browse species such as serviceberry, chokecherry, mountain maple and snowbrush, but also emergency species such as nannyberry, have been browsed to the point of killing; note photographs in Figures 30 and 31. The foregoing appears to apply more especially to the slopes while the browse found in the stream bottoms is in relatively good condition. This is due in part to the fact that the bottom lands are generally only lightly used except during periods of severe snow storms and excessive snow depths.

The principal browse species found on the winter ranges are serviceberry, chokecherry, snowbrush, mountain maple, snowberry, kinnikinnick, nannyberry, ninebark, Oregon grape, red osier dogwood, alder, mock orange, willow, birch, rose and spirea.

For the purpose of this report relative to the impact of dam construction on wintering populations and ranges the Fisher River-Wolf Creek Unit will be divided into the following two areas: (1) that portion to be referred to as the lower Fisher River-Wolf Creek drainage which is the wintering area from the confluence of Schrieber Creek with the Fisher River, downstream to the Kootenai River; and (2) that portion to be referred to as the Pleasant Valley Fisher, which is the continuation of the wintering area from Schrieber Creek

Figure 30. Overutilization of Nannyberry in the Fisher River-Wolf Creek area

Figure 31. Severe utilization on Douglas fir reproduction -- Fisher River-Wolf Creek area

south and eastward to the Pleasant Valley River. In analyzing the impact of a dam at River Mile 204.9 it was found that the effects, as a whole, would be primarily restricted to the winter area of the lower Fisher River-Wolf Creek country.

Table 19.[25/] Species use of the total winter range area (50,910 acres) within the lower Fisher River-Wolf Creek drainages.

Species	Acres	Percent of Total Area
White-tailed deer	28,160	55.3
Mule deer	5,130	10.1
Elk	38,140	74.3

Table 20. Species and interspecies use on the winter ranges within the lower Fisher River-Wolf Creek area.

Species	Acres	Percent of Total
White-tailed deer (only)	11,590	22.8
Mule deer (only)	920	1.8
Elk (only)	19,830	39.0
White-tailed deer and mule deer	260	0.5
White-tailed deer and elk	14,360	28.2
Mule deer and elk	2,000	3.9
White-tailed deer, mule deer and elk	1,950	3.8
Total	50,910	100.0

Within the lower Fisher River-Wolf Creek drainage deer and elk herds utilize a total land area of approximately 50,910 acres[26/] as normal

25/ Acreages are based on the total area that each species normally forage over and do not take into consideration mixed or overlapping ranges.

26/ All winter range figures were derived on the basis of a normal or average winter in this area and are subject to acreage fluctuation dependent upon snow conditions.

winter range. White-tailed deer utilize 28,160 acres of this total area, mule deer 5,130 acres and elk 38,140 acres, Table 19. Eighteen thousand five hundred and seventy acres or 36.6 per cent of the total acreage is classified as mixed range. Table 20 shows the total range use by species and species combinations for this area. The winter range areas within the Pleasant Valley Fisher drainage will not be analyzed in detail.

Wintering populations - deer and elk. Since the mid 1930's many big game population and range studies have been, and are being, conducted on the lower Fisher River-Wolf Creek area. Intensive white-tailed deer herd population studies were made during the winters of 1947-48 (Zajanc), 1948-49 and 1949-50 (Schmautz and Zajanc) and again in 1953-54 (Blair and Wilson). Total populations derived from these studies were: approximately 6,700 white-tailed deer (based on 0.24 deer per acre) for the winter of 1947-48; 7,250[27] for the winter of 1948-49; 6,000-8,000 for the winter of 1949-50; and 10,900 for the winter of 1953-54.

During the winter of 1947-48 (Zajanc) a white-tailed deer population of approximately 970 animals (based on 0.14 deer per acre) was determined for the Pleasant Valley Fisher drainage. Since that time no estimates have been made relative to that particular area. However, from all observations the herd has increased in proportion to that of the lower Fisher River-Wolf Creek area.

To date very little is known on the mule deer and elk herd within the Fisher River-Wolf Creek Unit. The total mule deer populations have been estimated as 1,500, 2,500, 3,000 and 3,000 animals for the years of 1948, 1950, 1953 and 1954, respectively. However, it is felt that the two latter estimates are considerably high. Elk populations have been estimated as 400, 400 and 500 animals for the years of 1948, 1950 and 1954, respectively. From field observations it appears that the elk herds in this area are slowly increasing, as is further evidenced by the herd estimates.

On the basis of the winter range and population figures presented for white-tailed deer within the lower Fisher River-Wolf Creek drainages, the serious matter of browse overutilization can readily be understood. During the past winter approximately 10,900 animals utilized a total range of 28,160 acres. This is one deer for every 2.5 acres for a normal use period of about 3½ months. For the last 20 years it has been noted that the increasing white-tailed deer population has been on an inverse proportion to the trend in range carrying capacity. Factual data is not available on the carrying capacity, although at the present time the herd is known to be far in excess to that of a proper stocking in relation to range condition. The problem is

27/ This population was derived only for that area from the Squaw Creek drainage down the Fisher River to Cody Creek, including Wolf Creek, and does not apply to the entire lower Fisher River-Wolf Creek winter range area.

further antagonized during periods of excessive snow accumulation. As previously discussed, white-tailed deer were forced to restrict their winter range from mid-January to mid-February 1954, to a total area of 10,750 acres because of excessive snow depths on the steep slopes. This amounted to 1 deer for every 0.99 of an acre for a period of approximately 20-25 days. From this it is evident that under the existing range-population condition a great percent of the herd could be lost through starvation in the event of an overly severe winter.

Hunter harvest. As pointed out on the Libby Management Unit, the deer and elk are normally still on their summer ranges during hunting season. Hence, there is not a feasible method known to determine what percent of the animals wintering within the Fisher River-Wolf Creek Unit are taken annually by hunter harvest. One basic fact is prevalent here as well as over a greater part of the county; deer harvest is insufficient in conjunction with existing populations.

For several years accurate data has been obtained by the Montana Fish and Game Department on the annual deer harvest during the either sex season within the lower Fisher River-Wolf Creek area. Generally data was collected by checking stations during the either sex season only as the kill during buck season is normally a very small percent of the total. The average28/ deer harvest within the area has been approximately 388 white-tailed deer and 58 mule deer annually. This insufficient harvest results not only in a loss of harvestable animals through winter mortality, Figures 32 and 33, but also jeopardizes the future of the white-tailed deer herds by permitting the overstocked winter ranges to be depleted beyond feasible recovery. If this situation continues, it is quite probable that starvation may be the factor that is more apt to control the herds rather than hunting.

No data was available on the elk harvest for the Fisher River Unit as a whole. However, during the big game season of 1952, 1953 and 1954 hunters harvested 6, 1[illegible] and 24 bull elk, respectively, within the lower Fisher River-Wolf Creek area.

Impact of the proposed Libby Dam (Mile 204.9) on deer and elk resources within the Fisher River-Wolf Creek Management Unit. The construction of a dam at River Mile 204.9 and the variety of probable effects that can ensue are of particular concern within the Fisher River Unit. In as much as these effects will apply primarily to the lower Fisher River drainage the analysis of impact presented here will be restricted to

28/ Averages were based on the deer kill recorded by checking stations during the either sex deer hunting seasons for 1949, 50, 52, 53 and 54.

Figure 32. White-tailed buck lost through winter starvation -- Wolf Creek area

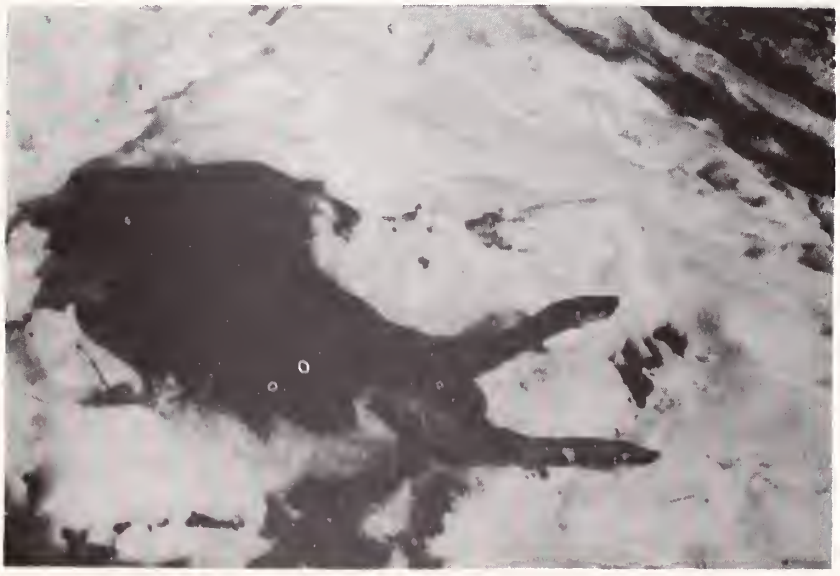

Figure 33. White-tailed deer lost through winter starvation -- lower Fisher River area

that area. There would definitely be a certain degree of impact upon the Pleasant Valley Fisher wintering ranges and populations due to the interarea movement of a few animals, however, the intensity of effects would be insignificant.

Again it must be noted that by and large, specific predictions cannot be made nor conclusions drawn on the probable effects that can arise through dam construction. Animal behavior responses are controlled and influenced by numerous variable factors, many of which cannot be pre-determined at this time. The principal effects to be analyzed and discussed with respect to this area are: (1) the direct loss of winter range land by inundation, and (2) the relocation of the Great Northern Railroad and its potential impact upon wintering white-tailed deer populations.

As noted earlier, summer ranges and their inhabiting big game populations do not constitute a problem relative to the proposed reservoir. Of concern here is the severity of impact upon wintering ranges and populations.

Within the lower Fisher-Wolf Creek drainage there is a total land area of approximately 50,910 acres classified as winter range for deer and elk, Figures 21, 22 and 23. Of this total acreage white-tailed deer utilize 28,160 acres, 2,660 acres or 9.4 percent of which will be inundated; mule deer utilize 5,130 acres, 360 acres or 7.0 percent of which will be inundated; and elk utilize 38,140 acres, 1,870 acres or 4.9 percent of which will be inundated by the proposed reservoir. The species use of the total wintering area and that portion to be inundated is shown in Table 21. Eighteen thousand five hundred and seventy acres or 36.5 percent of the total winter area is classified as mixed range utilized by species combinations. Of this, 1,870 acres or 10.1 percent will be inundated. Table 22 shows the species and interspecies use on the winter ranges as well as the proportionate acreage to be inundated.

The area to be lost through flooding consists of stream bottoms and an expanse of low bench lands; the latter being remnants of early glacial lakes. During the normal wintering activity of deer and elk these lower elevations are only lightly used. As a result the total loss of range by flooding will not present a serious problem during average winters. However, the situation imposed with the occurrence of critical periods is of major importance, as previously pointed out. During these periods the total white-tailed deer and elk populations are forced to restrict their activities to the lower benches and bottomlands. The area then becomes essential to the continued welfare of the herds, especially in regards to the former species. For this reason an evaluation of impoundment effects must again be made in relation to conditions that prevail during critical periods.

Table 21.[29] Species use of the total winter range area (50,910 acres) within the lower Fisher River-Wolf Creek drainage and the proposed range loss by inundation.

Species	Total Acres	Proposed Acres Inundated	Percent of Range Use Reduction
White-tailed deer	28,160	2,660	9.4
Mule deer	5,130	360	7.0
Elk	38,140	1,870	4.9

Table 22. Species and interspecies use on winter ranges of the lower Fisher River-Wolf Creek drainage and the proposed range area to be inundated.

Species	Total Acres	Acres Inundated	Percent of Total Area
White-tailed deer (only)	11,590	790	6.8
Mule deer (only)	920		
Elk (only)	19,830		
White-tailed deer and mule deer	260		
White-tailed deer and elk	14,360	1,510	10.5
Mule deer and elk	2,000		
White-tailed deer, mule deer, and elk	1,950	360	18.5
Total	50,910	2,660	5.2

Based on the fact that the bottomlands are essential, it would be necessary to reduce and maintain the existing white-tailed deer population in relation to critical periods. The percentage of herd reduction for a proper range stocking adjustment cannot be logically determined at this time. However, it is felt that the present herds would have to be reduced drastically in view of the already severly overutilized range conditions.

29/ Acreages are based on the total area that each species normally forages over and do not take into consideration mixed or overlapping ranges.

To compensate for the loss of relatively flat bottomlands many of the animals would be forced onto the reservoir ice. As discussed on the Libby Unit, edge food would be at a minimum here, especially as a result of impoundment draw-down. Ice hazards would also endanger the welfare of the animals. Another probability to consider is the animal adjustment to changes in habitat whereby the herds may move off of certain ranges or concentrate on localized areas. This would merely antagonize the overuse problem on existing ranges. Regardless of the animal or herd behavior responses the proposed reservoir will envoke many problems detrimental to white-tailed deer.

Elk populations utilizing the winter ranges are of considerable importance in relation to range competition with white-tailed deer, more especially during critical periods. With the onset of excessive snow accumulation elk also move to the lower benches and bottomlands where they directly compete with the white-tailed deer for available food. In view of this direct competition occuring at the present time on the overutilized deer ranges, careful consideration should be given to the disposition of elk in the event of dam construction. Following impoundment the existing population should be reduced and maintained at a level whereby they would not jeopardize the continuance of white-tailed deer. If range competition continues to endanger the deer, the elk should be removed entirely in as much as they are the secondary species. Reduction or removal of elk herds in relation to the proposed reservoir should be restricted to those herds that utilize the ranges abutting the lower Fisher River from Cow Creek downstream to the Kootenai River, Figure 23.

The flowage impact upon mule deer is felt to be of little or no consequence. Even though white-tailed deer and elk are forced into the bottoms during severe snow storms, mule deer remain at higher elevations. Here they manage to maintain lanes for movement. The 7.0 percent species range reduction by flooding, as shown in Table 21, is not as significant a loss as it appears. The area is frequented only occasionally by a relatively few mule deer.

The second major aspect of impact analyzed in this report is the proposed plans for relocating the Great Northern Railroad, as submitted by the U. S. Forest Service.[30] Figure 34[31] shows the

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30/ A detailed analysis of these relocation plans appear in the U. S. Forest Service report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953.

31/ The transportation relocation plans appearing in Figure 24 were reprinted by permission of the U. S. Forest Service from the U. S. F. S. report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953, p. 33.

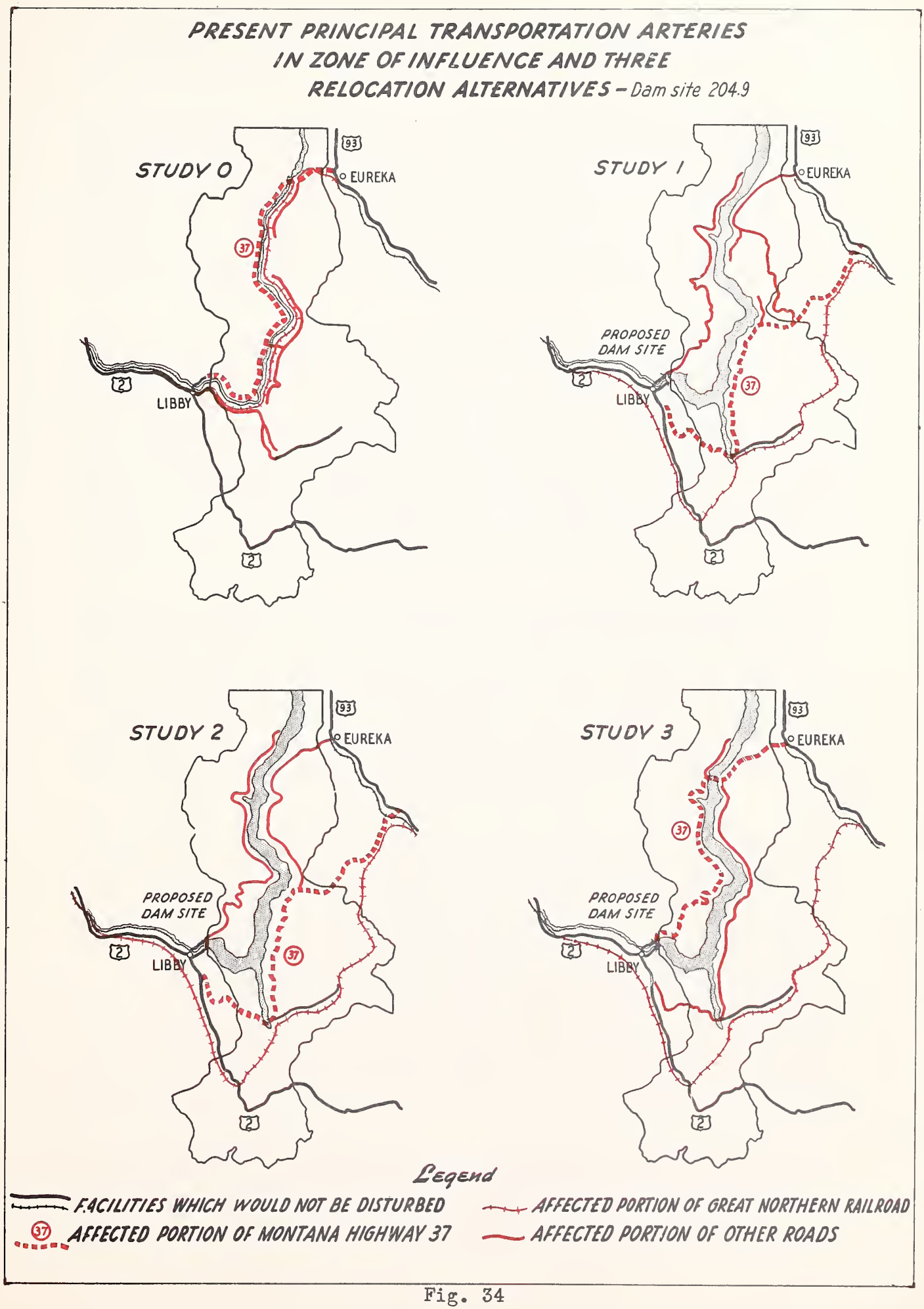

PRESENT PRINCIPAL TRANSPORTATION ARTERIES
IN ZONE OF INFLUENCE AND THREE
RELOCATION ALTERNATIVES – Dam site 204.9
STUDY 0
STUDY 1
STUDY 2
STUDY 3
EUREKA
LIBBY
PROPOSED
DAM SITE
93
37
2
Legend
FACILITIES WHICH WOULD NOT BE DISTURBED
AFFECTED PORTION OF MONTANA HIGHWAY 37
AFFECTED PORTION OF GREAT NORTHERN RAILROAD
AFFECTED PORTION OF OTHER ROADS

Fig. 34

present principal transportation arteries and the relocation alternatives for Dam Site 204.9. From this it can be seen that regardless of which one of these plans is adopted the rerouting of the Great Northern Railroad would remain the same.

The impact of relocation is of little concern from Libby to a point approximately 24 miles south. But at this point the tracks turn northeast into the lower Fisher River drainage. Here they continue downstream to the mouth of Wolf Creek where they turn east and proceed up this drainage. From the data presented relative to the sizeable deer and elk herds within the lower Fisher River-Wolf Creek area, the impact of the proposed railroad relocation through this area is readily discernable.

It would be during periods of excessive snow depth that the effects would be of greatest concern. The effects of herd movement onto the cleared tracks would rapidly result in devastation of the white-tailed deer and elk herds. During the critical winter period in 1954, various secondary logging access roads were cleared of snow in the lower Fisher River drainage. Hundreds of deer and sizeable numbers of elk immediately sought out these open areas for ease of movement. With the relocation of the railroad through this wintering area the animals would, by natural behavior, concentrate on the cleared tracts inducing mass slaughter by each passing train.

To alleviate such a major problem it is recommended that cooperative plans be initiated and financial agreements drawn up between involved agencies whereby the Great Northern right-of-way could be enclosed by deer proof fencing. Right-of-way enclosure should be from a point where the tracks enter the lower Fisher River drainage to approximately 8 miles up the Wolf Creek drainage. This would be a distance of approximately 22 miles. In addition, adequate cattle-type guards should be situated at both openings of the fence to insure against migrating animals gaining access to the track enclosure.

Upon fencing the railroad important migration and inter-range use routes would be blocked. To correct the problem it is felt that a system of big game underpasses would have to be constructed at various points along the track route. This is of special concern on the lower Wolf Creek area. White-tailed deer normally migrate in mass down the drainage to the west slopes of the lower Fisher River where they then divide; a portion of the animals moving to the north and a portion to the south. Also the wintering herds along the upper section of the lower Fisher River would need inter-range access routes. It is felt that in all probability deer and elk would soon accustom themselves to the location and use of the underpasses and thereby continue their normal pattern of migration to wintering areas.

Four underpasses would no doubt be adequate in permitting the continuation of normal animal wintering behavior. These should be located approximately as follows: (1) 1 mile up Wolf Creek, (2) near the mouth of Cow Creek, (3) between the mouths of Snell and

McKillop Creeks, and (4) near the mouth of Squaw Creek. All the streams referred to in location are secondary drainages of the lower Fisher River.

It appears that the action of fencing and construction of underpasses would alleviate the impact of the Great Northern Railroad upon the big game populations within the wintering area. The point to be stressed is the essential need of this action as an assurance toward the welfare and continuance of white-tailed deer herds using the lower Fisher River-Wolf Creek wintering area.

Jennings-Gateway Management Unit

The greater part of the Unit, Figure 20, consists of forested land, with the exception of a few scattered bottomland ranches, the townsites of Warland, Ural and Rexford, and the rolling grassland hills north of Rexford. Topography over many portions of the area is quite rugged, made up of terraced benches interspersed with rock cliffs. This type of terrain is prevalent adjacent to the Kootenai River from Tenmile Creek north to Stonehill. Figures 7 and 36 typify the rugged and steep slopes of the aforementioned area. Elevations within the Unit vary from about 2,000 to 6,000 feet. In general, the Flathead Mountains comprise the eastern half of the area and the Purcell Mountains the western half, both ranges abutting the Kootenai River.

Annual snow depths are less of a problem here than within the Fisher River-Wolf Creek Unit. Average depths range from approximately 6 inches to 2 feet. Winter temperatures drop as low as 30 degrees below zero, however, in general, the thermometer seldom drops below a minus 10 degrees.

Summer range - deer and elk. The Jennings-Gateway Management Unit comprises a total land area of approximately 500,050 acres, all of which is classified as summer range for deer and elk. However, the great majority of animals utilize the north and east exposed slopes of dense timber during the summer months.

In general, the summer range can be classified into four major vegetative types as on the two preceeding Management Units: (1) streambottom types consisting primarily of broadleaf species such as cottonwood, birch, alder, dogwood and willow; (2) open ponderosa pine types on the southern and western slope exposures with a ground cover of various browse species such as serviceberry, chokecherry, snowberry, Oregon grape, spirea, ninebark, nannyberry and snowbrush; (3) dense Douglas fir-western larch-lodgepole pine types on the northern and eastern slope exposures with a ground cover of various browse species such as mountain maple, nannyberry, serviceberry, snowberry, rose and kinnikinnick; (4) open grassy or brush hillsides interspersed with browse species such as mock orange, ninebark, serviceberry, snowbrush, redstem ceanothus and chokecherry. In addition to the

Figure 35. Winter mule deer and mountain sheep winter range near Stonehill -- Jennings-Gateway Management Unit

Figure 36. Mule deer and mountain sheep winter range south of Stonehill -- Jennings-Gateway Management Unit

four preceeding general types there is a localized area of approximately 900 acres consisting of a cedar, western larch and spruce vegetative type. This type is situated on the Kootenai River lowlands across from the townsite of Ural.

Deer and elk begin their annual migration or dispersion off the winter ranges and onto the summering areas in late March or early April. This movement is primarily dependent upon the existing conditions of snow depth at higher elevations and on the north and east exposures. Movement off these ranges toward the winter concentration areas generally begins in late October. Again prevailing snow conditions influence this movement. Early snowstorms at higher elevations tend to activate the fall migration. The intensity of movement is proportional to the severity and duration of these storms.

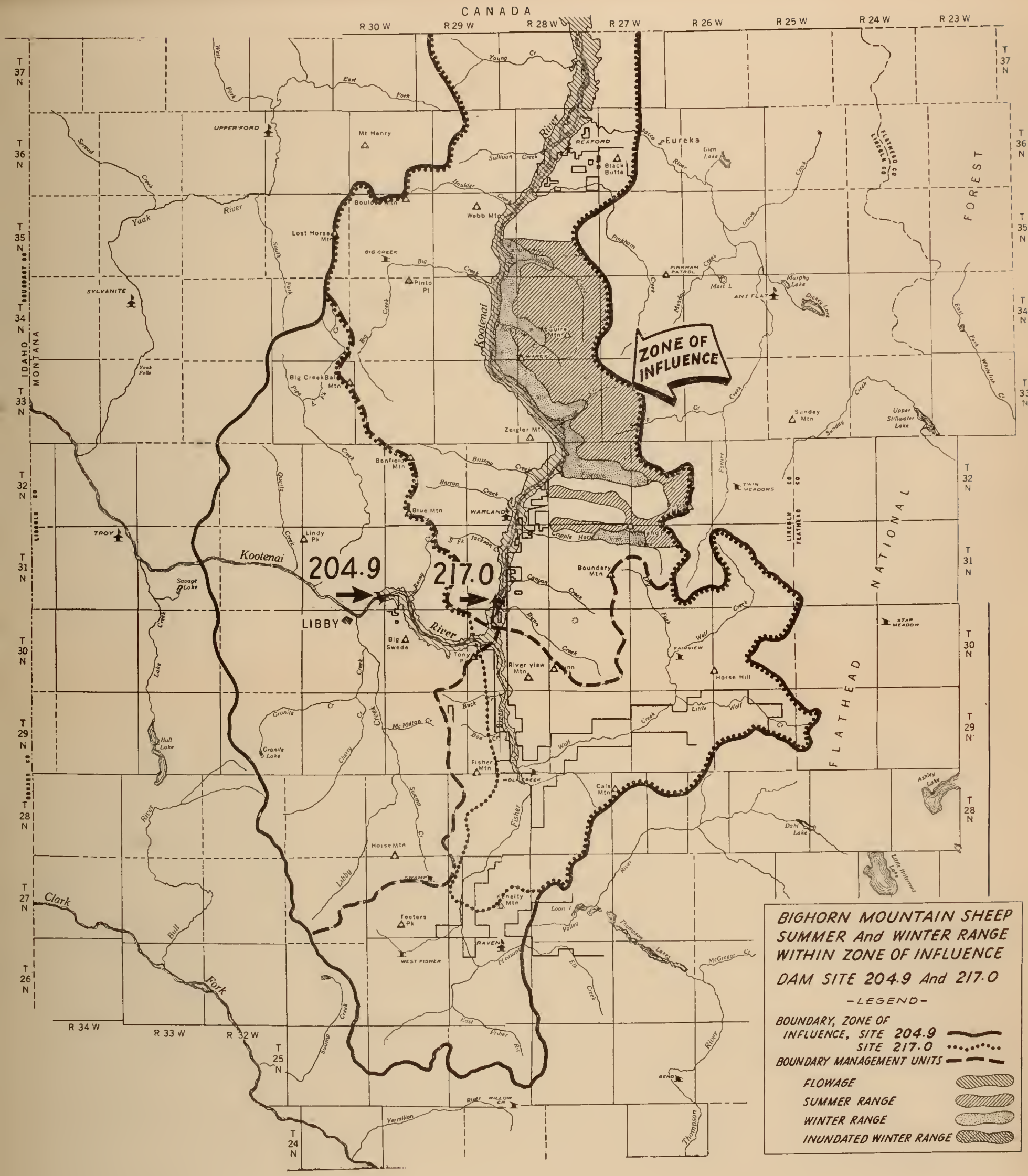
Throughout the Unit there is an overabundance of excellent summer range. Hence the construction of a dam at River Mile 204.9 would not effect the normal activities of summering deer and elk populations.

Summer range - bighorn mountain sheep. The Ural-Tweed bighorn sheep herd is confined to ranges lying within the Jennings-Gateway Unit. The summer range of this species comprises a total land area of approximately 69,650 acres, located on the east side of the Kootenai River from Cripple Horse Creek north to Beartrap Mountain above Stonehill. Figure 37 shows the bighorn sheep summer range area in the Flathead Mountains.

The open ponderosa pine vegetative type at higher elevations is most generally utilized by the sheep as summer range. However the extremities shown in Figure 37 are inclusive of all four general types previously discussed under summer big game ranges. The dense Douglas fir-western larch-lodgepole pine type is used to some extent though primarily as passage areas. A great many of the ewes and lambs utilize the area depicted as winter range throughout the year, foraging on the south and west exposed bunch grass benches adjacent to the Kootenai River.

Bighorn sheep have been observed in areas other than shown in the included range map although no factual data was available for establishing new range extremities. Observations have been made on small numbers of animals on the west side of the Kootenai River near Stonehill and also in the southern part of the County near McGinnis Creek. All known authenticated observations were made during the winter months on these areas.

Winter range - deer, elk and bighorn sheep. Of the three management units discussed in this report the least amount of information on winter range and wintering behavior of big game was available for the Jennings-Gateway area. For this reason the findings on the two former units have been used as a guide in drawing conclusions and making recommendations where possible.



BIGHORN MOUNTAIN SHEEP
SUMMER And WINTER RANGE
WITHIN ZONE OF INFLUENCE
DAM SITE 204.9 And 217.0

-LEGEND-

BOUNDARY, ZONE OF INFLUENCE, SITE 204.9
SITE 217.0
BOUNDARY MANAGEMENT UNITS
FLOWAGE
SUMMER RANGE
WINTER RANGE
INUNDATED WINTER RANGE

FIGURE 37

The elevational distribution of wintering animals within the Unit is generally from stream bottom up to approximately 4,000 feet on the south and west open yellow pine exposures. Above the 4,000 foot elevation mean temperatures are well below freezing during the winter months with all precipitation accumulating in the form of snow. North and east exposures extend the range of this micro-climate well below 4,000 feet which results in excessive snow accumulation.

Due to the steepness of the slopes and more rugged topography, typical of this area, a greater part of the winter range is situated at lower elevations than on the Libby or Fisher River-Wolf Creek Units. The prevalence of mule deer range and populations over white-tailed deer can no doubt be attributed in part, to this rugged terrain. Figures 35 and 36 show the general type of area utilized as winter range. During milder and more open winters the big game species in question, more especially deer and elk, will also utilize the north and east exposures consisting of a dense Douglas fir-western larch-lodgepole pine type.

The winter ranges within the Unit can be classified into three general forest types: (1) stream-bottom types consisting of broadleaf trees such as cottonwood, birch, alder, dogwood and willow; (2) open ponderosa pine types located on the south and west exposures with a ground cover of various browse species such as chokecherry, nannyberry, serviceberry and snowbrush; and (3) open grassy and brushy ridge and slope types with browse species such as mock orange, serviceberry, chokecherry and ninebark. The first vegetative type is generally only lightly used during normal winters. The third type listed consists largely of terraced benches on steep cliffs utilized by mule deer and bighorn sheep. The maps in Figures 21, 22, 23 and 37 show the white-tailed deer, mule deer, elk and mountain sheep winter ranges, respectively, for the Unit.

Within the Jennings-Gateway Management Unit deer, elk and mountain sheep normally utilize a total land area of approximately 76,700 acres32/ as winter range. White-tailed deer forage over 30,080 acres of the total wintering area, mule deer over 37,040 acres, elk over 20,840 acres and mountain sheep over 27,320 acres, Table 23. Thirty-three thousand two hundred and eighty acres or 43.3 percent of the total area is classified as mixed range, utilized by variable species combinations of deer, elk and mountain sheep. Table 24 shows the range use by species and species combinations. The data presented in this table indicates the degree of interspecies competition for available winter range, especially with reference to elk, white-tailed deer and mountain sheep. The latter two species are those more highly desired by sportsmen of the County.

32/ All winter range figures were derived on the basis of a normal or average winter in this area and are subject to acreage flucuation, dependent on snow conditions.

Table 23.[33/] Species use of the total winter range area (76,700 acres) within the Jennings-Gateway Management Unit.

Species	Acres	Percent of Total Area
White-tailed deer	30,080	39.0
Mule deer	37,040	48.3
Elk	20,840	27.2
Mountain sheep	27,320	36.6

Table 24. Species and interspecies use on the winter ranges within the Jennings-Gateway Management Units.

Species	Acres	Percent of Total
White-tailed deer (only)	8,960	11.7
Mule deer (only)	8,930	11.6
Elk (only)	9,630	12.6
Mountain sheep (only)	15,900	20.7
White-tailed deer and mule deer	11,090	14.5
White-tailed deer and elk	3,170	4.1
Mule deer and elk	3,530	4.6
White-tailed deer, mule deer and elk	4,070	5.3
White-tailed deer and mountain sheep	1,560	2.0
Mule deer and mountain sheep	8,190	10.7
Elk and mountain sheep	440	0.7
White-tailed deer, mule deer, and mountain sheep	1,230	1.6
Total	76,700	100.0

As noted in Figure 37, the mountain sheep winter on an area adjacent to the Kootenai River from Cripple Horse Creek north to Beartrap Mountain. This area is typified in having a very rugged

33/ Acreages are based on the total area that each species normally forages over and do not take into consideration mixed or overlapping ranges.

topography consisting of a series of discontinuous benches and ledges varying in vertical height from a few feet to approximately 200 feet. The horizontal plane of these benches is relatively level and varies in width from a few feet to about 150 feet. Photographs in Figures 6, 7, 35, 36, 38 and 39 show representative portions of the terrain utilized by the Ural-Tweed mountain sheep herd as winter range.

Elk utilize the upper limits of their ranges throughout the greater part of a normal winter. However they have been observed feeding at lower elevations for short intervals even during average winters. With the onset of critical winter periods and an excessive accumulation of snow the elk and deer are forced off the steep slopes and into the valley bottoms. In as much as the mule deer range at lower elevations because of the rugged topography they too are forced into the bottom lands during critical periods. Such forced movement by this latter species was not found to be prevelent on the Libby or Fisher River-Wolf Creek Unit due, in part, to the animals ability to maintain movement through deep snow on less rugged terrain. A relatively few mountain sheep are also forced to the bottom lands during these critical periods. Figures 24 and 28 denote the occurrence of excessive snow depth as compared to that of a normal winter as shown in Figures 25, 26 and 29.

A specific range acreage reduction by species during critical periods was not obtained on the Unit. However, from field observations it can be readily assumed that the winter ranges are forcibly reduced by a percentage similar to that found on the lower Fisher River area during such periods.

As previously noted, the areas do get some year around use by deer, and more especially by mountain sheep (ewes, lambs and yearlings). The deer herds that annually migrate onto the winter areas are from the Flathead and Purcell mountains adjacent to the Kootenai River from Jennings to Gateway. Figure 2 shows the pattern of migratory routes. Mountain sheep move onto the winter ranges from their adjoining summer areas shown on the map in Figure 37. Even though the seasonal movements of elk are not definitely known, it is felt that those animals wintering on the west side of the Kootenai River move in from summer range areas immediately to the northwest. Those wintering on the east side of the river appear to move in from summer areas situated north of the Kootenai-Wolf Creek divide.

Winter range conditions within the Unit are as a whole, somewhat better than on the two preceeding Units. However, there is some overutilization on the Warland area though this is not severe. The principal browse species found on the ranges are serviceberry, chokecherry, snowbrush, Oregon grape, red osier dogwood, mountain maple, kinnikinnick, mock orange, snowberry, redstem ceanothus, rose, willow, red birch, alder, nannyberry, ninebark, cottonwood and some bitterbrush on localized areas. The latter species is most abundant

Figure 38. Rugged terrain of Ural-Tweed mountain sheep winter range in the vicinity of Ural, Montana

Figure 39. Ural-Tweed mountain sheep winter range north of Ten Mile Creek

in the vicinity of Young Creek. Species of grasses[34] found on the terraced rock benches of the mountain sheep range consist of bluebunch wheatgrass, Sandberg bluegrass, beardless wheatgrass, rough fescue and purple reedgrass. Sedges are also present on these rugged bench areas. Common perennials and annuals[34] on this area are alumroot, beardtongue, buckwheat, buttercup, arnica, yarrow, balsamroot and stonecrop.

Both the summer and winter ranges are utilized to some extent by domestic livestock. However the livestock-big game range competition would be greatly reduced or obliterated by the construction of a dam and the inundation of bottomland ranches.

Wintering populations - deer and elk. The most intensive and recent big game population study conducted on the Unit was by Zajanc during the winter of 1947-48. Findings of this study noted that there was a white-tailed deer population of approximately 1,260 animals and a mule deer population of about 2,010 animals inhabiting the ranges. As previously noted, the predominance of the latter species can no doubt be attributed primarily to the rugged type of terrain which is typical of the area, especially from Five Mile Creek north to Stonehill.

Little is known to date on the number of elk that utilize the winter ranges. The main herd concentrations are located on Alexander, Dunn, Canyon and Cripple Horse Creeks. From observations made by interested agencies it is felt that the elk are slowly increasing annually.

Wintering population - mountain sheep. The most reliable studies conducted on the Ural-Tweed sheep herd were in 1941 (Brink) and 1947-48 (Zajanc). At these times it was concluded that the wintering population was approximately 100 and 168 animals, respectively. Subsequent estimates by the U. S. Forest Service and the Montana Fish and Game Department have varied the population between 145 and 400 animals. The last estimate figure, 1953, placed the herd at 400 animals. From all indications this figure is considerably high and it is felt that the present total population probably does not exceed 150-175 animals.

For some years there has been speculation of theories as to why the sheep herd is remaining more or less static. However, to date specific investigations have not been conducted relative to this matter.

Hunter harvest. Little factual data was available on the annual hunter harvest for the Unit. However, from known data throughout the County it can be readily assumed that the deer and elk harvest

34/ Species of grasses and annuals obtained from report, Ural-Tweed Sheep Project, B. W. Brink, U. S. F. S., 1940-41.

is also insufficient here. This light hunter take can be attributed, in part, to the rugged terrain which increases the difficulty in pursuing huntable animals.

The legal hunting of mountain sheep in the Ural-Tweed herd was opened for the first time during 1954. Hunting was conducted on a permit system basis whereas only male sheep with at least a three-quarter curl could be taken. Five permits were issued and from information received to date only two hunters were successful.

Impact of the proposed Libby Dam (Mile 204.9) upon the deer, elk and mountain sheep resource within the Jennings-Gateway Management Unit. The principal impact that will be initiated on the Jennings-Gateway Unit by the construction of a dam at River Mile 204.9 will be the loss of big game ranges as a result of reservoir inundation. The analysis of impact presented herein will be restricted to this range loss effect even though the proposed dam will no doubt encite other indirect effects upon the big game resources.

In as much as the summer range area is situated primarily at higher elevations and is excellent in condition the effects of the proposed reservoir on this area will not be of any significance. The winter range, as previously noted, comprises the limiting factor to existing big game populations, hence, it is the area of major concern relative to this report.

Within the Unit there is a total land area of approximately 76,700 acres classified as deer, elk and mountain sheep winter range, Figures 21, 22, 23 and 37. Of this total area white-tailed deer utilize approximately 30,080 acres, 12,440 or 41.4 percent of which will be inundated; mule deer utilize 37,040 acres, 10,010 acres or 27 percent of which will be inundated; elk utilize 20,840 acres or 10.7 percent of which will be inundated; and mountain sheep utilize 27,320 acres, 3,660 acres or 13.4 percent of which will be inundated. The species use of the winter range area and the acreage lost by inundation is shown in Table 25. Thirty-three thousand two hundred and eighty acres or 43.4 percent of the total acreage is classified as mixed range, utilized by species combinations of deer, elk and mountain sheep. Eleven thousand and sixty acres or 34.1 percent of this will be inundated. Species and interspecies use on the winter ranges is shown in Table 26.

In analyzing the possible problems to be brought about by the proposed reservoir it was found to be very difficult, and virtually impossible in many instances, to set forth precise conclusions and recommendations. Alleviations to many of the problems are unanswerable. Also, the many influencing and variable factors that control animal behavior response such as climatic conditions, range use, and the unequal animal distribution on the ranges, necessitated on the presentation of probable situations that are likely to arise.

The winter range area to be lost by inundation consists primarily of stream bottoms and low bench lands. This portion of the range is only lightly used by big game animals during the course of a

Table 25.[35] Species use of the total winter range area (76,700 acres) on the Jennings-Gateway Management Unit and the proposed range loss by inundation.

Species	Total Acres	Proposed Acres Inundated	Percent of Range Use Reduction
White-tailed deer	30,080	12,440	41.4
Mule deer	37,040	10,010	27.0
Elk	20,840	2,230	10.7
Mountain sheep	27,320	3,660	13.4

Table 26. Species and interspecies use on winter ranges of the Jennings-Gateway Management Unit and the proposed range loss by inundation.

Species	Total Acres	Acres Inundated	Percent of Total Area
White-tailed deer (only)	8,960	3,610	40.7
Mule deer (only)	8,930	460	5.2
Elk (only)	9,630		
Mountain sheep (only)	15,900	70	0.4
White-tailed deer and mule deer	11,090	5,250	47.3
White-tailed deer and elk	3,170	1,200	37.8
Mule deer and elk	3,530		
White-tailed deer, mule deer and elk	4,070	1,020	25.1
White-tailed deer and mountain sheep	1,560	310	19.9
Mule deer and mountain sheep	8,190	2,230	27.2
Elk and mountain sheep	440		
White-tailed deer, mule deer, and mountain sheep	1,230	1,050	85.4
Total	76,700	15,200	19.8

35/ Acreages are based on the total area that each species normally forages over and do not take into consideration mixed or overlapping ranges.

normal winter. However, again the situation exists whereas these lowlands are essential to the continued welfare of the deer herds during critical winter periods of excessive snow depth. In view of this it is necessary to base the impact of the proposed dam upon big game in direct relation to the occurrence of such periods. Even though the frequency of these periods was not determined they were known to have existed during the winters of 1941-42, 1944-45, 1946-47 and 1953-54. As previously noted, the occurrence of severe snow storms and excessive snow accumulation forces the deer and elk off the steep slopes. The animals are then compelled to restrict their movements to the bottomlands. Here the total area of use is only a fraction of the normal winter range.

The 41.4 percent or 12,440 acre range loss to white-tailed deer by inundation and the 27.0 percent or 10,010 acre loss to mule deer during the course of normal winters, will no doubt necessitate a herd reduction toward maintaining a proper range-animal balance. The extent of reduction to offset the range loss impact is not predictable, especially in view of the fact that these bottomlands are only lightly used during average winters. The 10.7 and 13.4 percent range loss to elk and mountain sheep, respectively, during average winters, appears to be of little significance due to the ranging habits of these species.

With the occurrence of a severe snow depth period the loss of bottomland areas then becomes a critical matter to all four species in question, more especially deer. It is during such periods that the maintainance of a continuing herd is in jeopardy. However, again the species response cannot be predicted with any certainty. It has been shown that the extremities of the winter range are forcibly constricted to approximately one-half or less of the normal wintering area during these periods. Here the animals are concentrated where competition for available food is highly acute among species. Due to the rugged terrain of the Jennings-Gateway Unit all, or a great portion, of the land to be flooded on the winter area will be that utilized as critical range, with the exception of that for mountain sheep. This species has shown a greater capability towards existance during excessive snow conditions by remaining in the shelter of rock ledges above the flowage line. However some of the animals have been forced to the lowlands as indicated by field observations and records of those killed by passing trains. From this it appears that the existing sheep herds will not loose as large a percentage of their critical range through impoundment as deer and elk. However a population adjustment would possibly become necessary for the continued welfare of the entire herd.

Considering deer and elk, especially white-tailed deer, there is no compensation for the loss of this essential range type. The relatively flat lowlands must be available to the animals for purposes of continued mobility and feeding throughout the duration of excessive snow accumulation periods. Even under the present conditions these critical periods often induce tremendous white-tailed deer winter lossed through starvation. Mule deer and elk suffer less

due to their size advantage relative to feeding.

From all observations and factual data it appears that the impact of the proposed reservoir during critical periods will not only primarily control the size of deer and elk herds on the Unit but will also endanger the probability of their continued existence in reasonable numbers. It is apparent that the deer populations will have to be reduced and maintained relative to the occurrence of critical periods, though to an unpredictable level. The remaining white-tailed deer and a large portion of the mule deer population will seek out movement on the reservoir ice during severe periods. As previously discussed, food availability would be at a minimum along the edges of the frozen impoundment due to the water draw-down at this time of year. This draw-down would also induce hazardous ice conditions along the edges. In an effort to continue feeding there is the possibility that deer herds would shift from their accustomed area to new locations or even concentrate on small localized sections where food was available. In the event of any one or a combination of these probabilities it is quite possible that the population would suffer devastating losses through starvation should the critical period be prolonged for any length of time.

Elk herds would have to be closely observed, even during normal winters, in view of their detrimental effects on white-tailed deer. Here again, it appears that the species population will have to be maintained at a low level, possibly to the point of complete removal in an effort to give the deer herds the advantage needed for continued survival in huntable numbers.

APPENDIX C. BIG GAME INVESTIGATION - DAM SITE 217.0

The impact of a dam at River Mile 217.0 upon the big game resources of Lincoln County, as resolved by the Montana Fish and Game Department, is presented in the following analysis. In appraising the impact only deer, elk and mountain sheep have been evaluated in this report. The effects upon moose, bear and mountain goats will be of little or no significance.

The big game Zone of Influence for Dam Site 217.0, Figure 19, is composed of a total land area of approximately 704,845 acres. By noting Figures 8 and 19 it can be seen that the designated zone corresponds in area to the Jennings-Gateway Management Unit (500,050 acres) plus a greater part of the lower Fisher River-Wolf Creek drainage (204,795 acres). Both of these areas have previously been discussed in detail under Dam Site 204.9. To avoid undue repetition, in as much as the maximum reservoir elevation (2,459 feet) is the same for both dam sites, many phases of the analysis will be omitted here with reference made to the detailed discussion in Appendix B.

Big game summer and winter ranges, populations and hunter harvest will not vary, in general, from that previously discussed for the two specific areas in question. Figures 21, 22, 23 and 37 show the winter ranges of white-tailed deer, mule deer, elk and mountain sheep, respectively, within the Zone of Influence for Dam Site 217.0

Impact of the proposed Libby Dam (Mile 217.0) upon the deer, elk and mountain sheep resources within the Zone of Influence.

The probable impact to be envoked upon big game with a dam constructed at Mile 217.0 can be classified into two major categories: (1) direct loss of winter range by inundation and the ensuing animal responses, and (2) relocation of the Great Northern railroad and its effects upon big game. The range loss impact will be entirely restricted to that area formerly designated as the Jennings-Gateway Management Unit. In as much as the effects here will be primarily the same for either dam site, a repetorial analysis has been omitted. Reference is made to Appendix B for a detailed discussion of the reservoir impact upon the Jennings-Gateway Unit.

The proposed plan for relocating the Great Northern Railroad relative to Dam Site 217.0, as submitted by the U. S. Forest Service, is of great concern to this report. Figure 40[36] shows the

36/ The transportation relocation plans appearing in Figure 24 were reprinted by permission of the U. S. Forest Service from their report, Impact of the Proposed Libby Dam Upon the Forest Economy of Lincoln County, Montana, August 1953, p. 40.

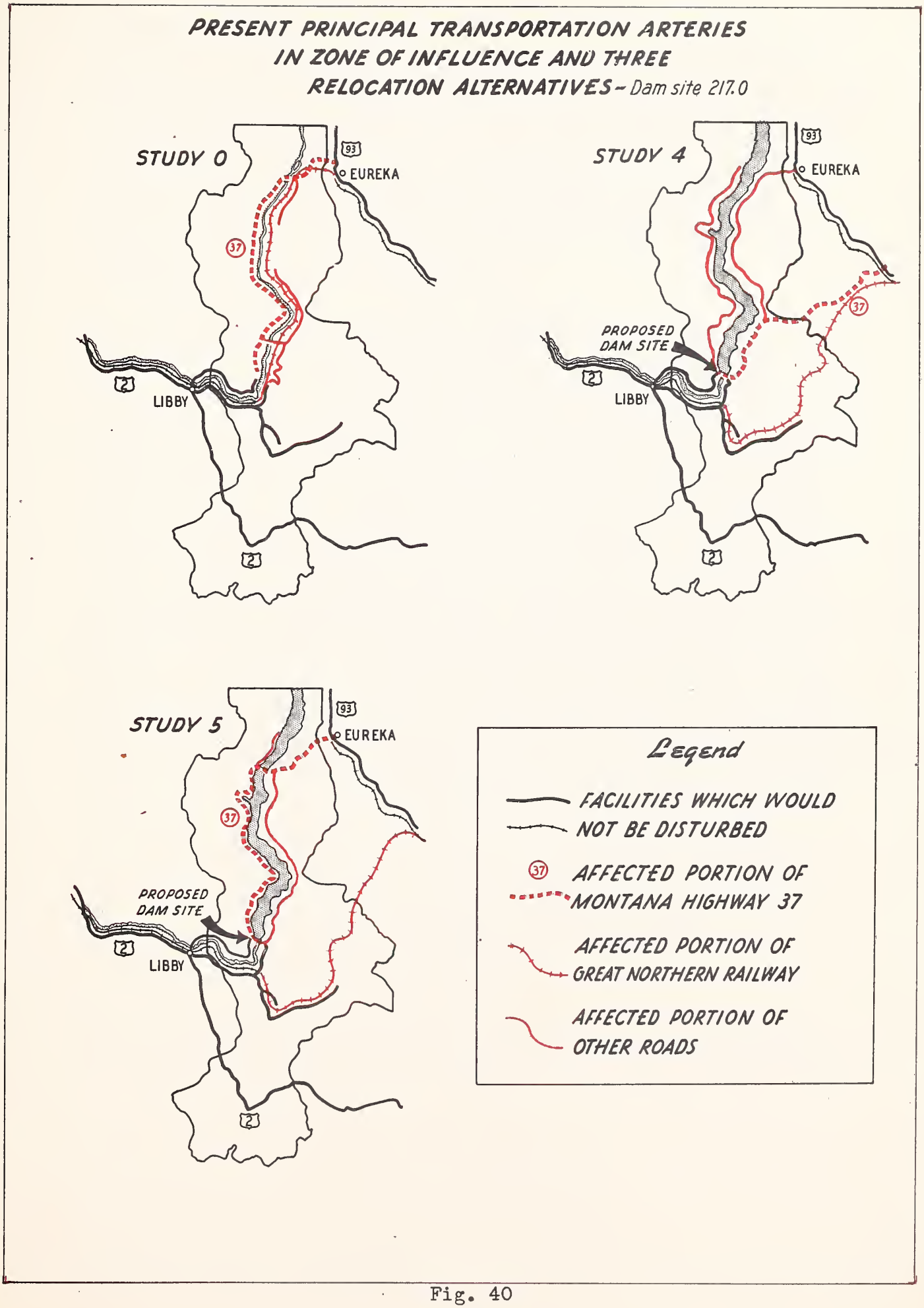

PRESENT PRINCIPAL TRANSPORTATION ARTERIES
IN ZONE OF INFLUENCE AND THREE
RELOCATION ALTERNATIVES - Dam site 217.0
STUDY 0
93
EUREKA
37
LIBBY
2
STUDY 4
93
EUREKA
PROPOSED
DAM SITE
37
LIBBY
2
STUDY 5
93
EUREKA
37
PROPOSED
DAM SITE
LIBBY
2
Legend
FACILITIES WHICH WOULD
NOT BE DISTURBED
37
AFFECTED PORTION OF
MONTANA HIGHWAY 37
AFFECTED PORTION OF
GREAT NORTHERN RAILWAY
AFFECTED PORTION OF
OTHER ROADS

Fig. 40

present principal transportation arteries and the relocation alternatives for Dam Site 217.0. Regardless of which plan should be adopted the relocation of the railroad would remain the same. From Libby to Jennings the impact would be of little concern. However, at approximately the latter point the tracks would turn south and follow the lower Fisher River to the mouth of Wolf Creek. Here they would turn northeast and proceed up this drainage toward Stryker. From the data presented in Appendix B relative to the sizeable deer and elk herds wintering within the lower Fisher River-Wolf Creek area the adverse impact of the proposed railroad relocation is readily discernable.

In general, the effects upon the area would be similar to that previously described in Appendix B. Whereas, during periods of excessive snow accumulation, in particular, a great proportion of the white-tailed deer herds and sizeable numbers of elk would seek out the cleared tracks for ease of mobility. This would enduce mass slaughter by each passing train. To alleviate such a devastating effect the following action is recommended in the event a dam is constructed at Mile 217.0 and the railroad is relocated as proposed in Figure 40. Cooperative plans should be initiated and financial agreements drawn up between involved agencies whereby the Great Northern Railroad right-of-way could be adequately fenced against big game through the effected area. This would entail enclosing the right-of-way in deer proof fence from the old townsite of Jennings to a point approximately 8 miles up the Wolf Creek drainage; a total distance of about 19 miles. In addition, adequate cattle-type guards should be situated at both openings of the fence to insure against migrating animals gaining access to the track enclosure. To allow for the continuation of normal ancestral migration and inter-range movement where routes are intersected by the proposed railroad, it is also recommended that a system of big game underpasses be constructed at strategic locations. This is of special concern for deer herds migrating in from both the McMillan Range and upper Wolf Creek drainage. Four such underpasses would no doubt be adequate in permitting the continuation of normal wintering behavior, as discussed in Appendix B. These should be located approximately as follows: (1) 1 mile upstream from the mouth of the Fisher River, (2) $\frac{1}{2}$ mile north of the mouth of Alder Creek, (3) near the mouth of Cody Creek, and (4) 1 mile up Wolf Creek.

The recommended actions presented here, or any others found to be more feasible, are essential in view of the continued welfare and existence of white-tailed deer herds wintering on the area.

APPENDIX D.

SCIENTIFIC NOMENCLATURE OF
TREES, SHRUBS, GRASSES AND FORBES

Trees

Cottonwood	Populus trichocarpa
Cedar	Thuja plicata
Douglas fir	Pseudotsuga taxifolia
Engelmann spruce	Picea engelmanni
Grand fir	Abies grandis
Hemlock	Tsuga heterophylla
Lodgepole pine	Pinus contorta
Quaking aspen	Populus tremuloides
Red birch	Betula fontinalis
Western larch	Larix occidentalis
White pine	Pinus monticola
Ponderosa pine	Pinus ponderosa

Shrubs

Alder	Alnus tenuifolia
Big sage	Artemisia tridentata
Bitterbrush	Purshia tridentata
Chokecherry	Prunus demissa
Kinnikinnick	Arctostaphylos urva-ursi
Mock orange	Philadelphus lewisii
Mountain maple	Acer glabrum
Nannyberry	Lepargyrea canadensis
Ninebark	Physocarpus malvaceus
Oregon grape	Berberis repens
Red Osier dogwood	Cornus stolonifera
Redstem ceanothus	Ceanothus sanguineus
Rose	Rosa sp.
Serviceberry	Amelanchier alnifolia
Snowberry	Symphoricarpos occidentalis
Snowbrush	Ceanothus velutinus
Spirea	Spirea lucida
Willow	Salix sp.

Grasses

Alfalfa	Medicago sativa
Barley	Hordeum sp.
Beardless wheatgrass	Agropyron inerme
Downy chess	Bromus tectorum
Idaho fescue	Festuca idahoensis
Needle grass	Stipa sp.
Oats	Avena sp.
Orchard grass	Dactylis glomerata
Pine grass	Calamagrostis rubescens

Grasses, continued.

Purple reedgrass	Calamagrostis purpraescens
Red top	Agrostis alba
Sandberg bluegrass	Poa secunda
Smooth brome	Bromus inermis
Timothy	Phleum sp.
Wheat	Triticum sp.
Rough fescue	Festuca scabrella

Forbs

Alumroot	Heuchera glabella
Arnica	Arnica sp.
Balsamroot	Balsamorhiza sagittata
Beardtongue	Pentstemon sp.
Buckwheat	Eriogonum sp.
Buttercup	Ranunculus glaberimus
Dogbane	Apocynum sp.
Lupine	Lupinus sp.
Stonecrop	Sedum sp.
Yarrow	Achillea lanulosa

F I G U R E S

T A B L E S